System Checkout Instructions

The System Checkout Instructions are to be used only after having received and assembled the MP-A Microprocessor/System board, MP-B Mother board, MP-C Serial Control Interface and the MP-P Power Supply. Set these instructions aside until you have completed the above assemblies.

The first board that must be checked out is the MP-P Power Supply. You must make absolutely sure that the voltages on the power supply board's output connector, J1 are correct as outlined in the following instructions. An error here could cause total disaster.

Set the MP-A Microprocessor/System board, MP-B Mother board, and the MP-C Serial Control Interface aside termprarily and work only with the MP-P Power Supply. The supply should already be attached and wired to the chassis base plate as it was at the completion of the MP-P Power Supply assembly instructions. The chassis front panel should be positioned with its lower edge against but not attached to the front edge of the base plate. The three power switch plug-on wires should already be attached to the front panel's POWER switch and there should be no connections to the front panel's RESET switch. The MP-B Mother board should not be clipped onto the chassis and its power connector must not be plugged onto the power supply board connector J1.

(✓) Check the power supply over with the Power Supply Wiring Diagram to make sure all connections have been made correctly.

(✓) Check to see that all wiring connections have been soldered and that there are no "cold" solder joints.

(✓) Check to see that fuses F1 and F2 are installed and are in their proper location.

NOTE: When going thru the following tests, do not proceed thru the checkout sequence if you have something that does not check correctly. Remove power and check the wiring first. If it looks OK, then reapply power and make whatever voltage measurements necessary to pin point the source of the problem.

(✓) WITH THE LINE CORD PLUG UNPLUGGED, use an ohmmeter to measure the resistance between lug strip TS-1 lug B on the chassis and each side of the line cord. It should measure infinite resistance (no continuity).

(✓) Remove the ohmmeter and plug the line cord into a wall outlet and check to see if the POWER switch lense is lit. If not depress the power switch. It should light. If not, unplug the unit and recheck your wiring.

NOTE: On this and following checks, when the power is ON, be sure not to come into physical contact with any AC power line connections such as those to the power switch on the front panel.

(✓) With the POWER still on measure the DC voltage across the large electrolytic capacitor C3, which is clamped to the chassis. It should read somewhere between 7.5 to 9.5 volts DC.

(✓) Now, with the POWER still on, check the +7 to +8, -12 and +12 voltages right at the power supply board connector J1 using pin 9 as the ground reference. The MP-P Power Supply Schematic shows the pin configuration for the connector. The +7 to +8 voltage should measure between +7.5 to +9.5 VDC. The -12 and +12 voltages may vary from 12 to 15 VDC. When making the voltage measurements on the power supply connector, be sure not to short any of the pins together.

(✓) Unplug the unit and use the extra 100 ohm 1/2 watt resistor supplied with the power supply kit to discharge the large electrolytic capacitor, C3 mounted on the chassis base plate. Hold the resistor right across the capacitor's lugs for about ten seconds to fully discharge it.

(✓) Check over the MP-B Mother board to see that all connections have been soldered and that there are no solder "bridges" or foil "breaks."

(✓) Orient the MP-B Mother board so its power connector so it aligns with J1 on edge of the chassis base plate and snap the board onto the nylon PC board supports. Make sure the board locks into place.

(✓) Orient the MP-B Mother board's power connector so it aligns with J1 on the power supply board and press it on. Make sure the plug-on connector seats firmly against its mate on the power supply board.

(✓) Take the two as yet unattached wires with the lug connectors on the end and attach each to one of the terminals on the RESET switch. It does not matter which wire connects to which terminal on the RESET switch S1 but YOU MUST NEVER GET ANY OF THESE WIRES INTERCHANGED WITH THOSE GOING TO THE "POWER" SWITCH, S2.

(✓) Use an extra wire tie supplied with the MP-P power supply kit to secure the two wires going to the RESET switch, S1.

(✓) Use three evenly spaced wire ties to bundle the wiring harness going from the MP-B Mother board to the power supply connector plugged onto the power supply board.

(✓) Having no boards plugged onto the MP-B Mother board again apply AC power to the unit. This time measure the power supply voltages right at the male connector pin row along the front edge of the MP-B Mother board. The functions of the various pins are labeled right on the PC board just behind the first connector pin row. Using one of the GND pins as a reference, the +7 VDC UNR buss should read from 7.5 to 9.5 VDC, the +12 buss should read from 12 to 15 VDC and the -12 buss should read from -12 to -15 VDC. Do not continue thru the checkout procedure if the measurements are not right. There is too great a possibility of damaging some rather expensive components.

(✓) With AC power still applied, measure the power supply voltages at the interface male connector pin row along the right rear edge of the MP-B Mother board. The functions of the various pins are labeled right on the PC board just to the left of the edge connector strip. Using one of the GND pins as a reference, the +8 UNR buss (same as 7 - 8 VDC UNR buss) should read from 7.5 to 9.5 VDC, the +12 buss should read from 12 to 15 VDC and the -12 buss should read from -12 to -15 VDC.

( ) Using one of the GND pins as a reference, check the voltage of the far right pin (as viewed from the front of the chassis) of the mother board's voltage regulator, IC2. The reading should be +5 VDC ±5%. If not, something is wrong.

(✓) Remove AC power and give the large power supply capacitor about ten seconds to discharge down. There is no need to use the 100 ohm 1/2 watt "bleeder" resistor since the current drawn by the mother board components is sufficient to discharge the capacitor.

NOTE: Whenever installing or removing any of the system's plug-on boards, be sure the ssytem is turned OFF and has been so for at least ten seconds. It is also a good idea to unplug the AC wall plug for added safety. Avoid touching the conductors on the various plug-on boards to reduce the possibility of static electricity damage to the various MOS semiconductors.

(✓) Check over the MP-A Microprocessor/System board to see that all connections have been soldered and that there are no solder "bridges" or foil "breaks". Intergrated circuits IC1 and IC2 of the MP-A board should not yet be installed on the circuit board.

(✓) Looking at the MP-B Mother board from the front of the chassis and with the MP-A Microprocessor/System board oriented so you are viewing the "TOP" side, set the board down lightly on the second connector pin row from the front of the Mother board. This is for convenience only, electrically the board may be plugged onto any one of the seven main board positions. Check to see that the index pin on both the MP-A board and MP-B board align. They should align, if not there is a mistake.

(✓) Assuming the index pin aligns, press the MP-A board down perpendicularly onto the mother board. Be sure the MP-A board seats firmly against the mother board.

(✓) Again apply AC power to the unit. Using one of the GND pins on the mother board as a reference, measure the voltage on the right most lead of voltage regulator IC17 on the MP-A board. The reading should be +5 VDC ±5%. If not, something is wrong.

(✓) Remove AC power.

(✓) Check over the MP-C Serial Control Interface to see that all connections have been soldered and that there are no solder "bridges" or foil "breaks".

(✓) Looking at the MP-B Mother board from the front of the chassis and with the MP-C Serial Control Interface board oriented so its "BOTTOM" side may be viewed from the left side of the chassis, set the board down lightly on the interface card connector row #1. The #1 position is the second connector row from the far left going from left to right while the first is #0. This is very important! Each of the interface connector rows is numbered right on the MP-B Mother board along its back edge adjacent the connector row.

(✓) Assuming the index pin aligns, press the MP-C board down perpendicularly onto the mother board. Be sure the MP-C board seats firmly against the mother board.

(✓) Double check to see that you just installed the MP-C Serial Control Interface on interface card connector position #1, the second connector position from the left.

(✓) Again apply AC power to the unit. Using one of the GND pins on the mother board as a reference, measure the voltage of the uppermost lead of the voltage regulator, IC2 on the MP-C Serial Control Interface board. The reading should be +5 VDC ±5%. If not, something is wrong.

(✓) If you have an oscillioscope, use one of the GND pins on the mother board as a reference and look at the signals on the 110b, 150b, 300b, 600b and 1200b buss lines on the mother board. You should see semi-square waves possibly with some glitches, switching between 0 and +5 VDC. The frequencies should be 1758.8, 2400, 4800, 9600, 19200 Hz respectively x ± 5%. These frequencies as well as the processor clock are all generated by the baud rate generator IC4 on the MP-A board and must be present for the system to work. If your system is not generating the various clock signals and you have checked the board over for solder "bridges", foil "breaks", correct board assembly, etc., try changing resistor R1 on the MP-A Microprocessor/System board to a 10 Meg ohm 1/4 watt resistor. In any case, do not continue assembly until the oscillator is working.

(✓) Remove AC power.

( ) Remove the MP-A Microprocessor/System board by pulling up slightly on one corner, then the other, alternating back and forth until the entire board is loose. Try to avoid touching any of the connections on the board to reduce the possibility of damage to the MOS semiconductors.

NOTE: MOS integrated circuits are susceptable to damage by static electricity. Although some degree of protection is provided internally within the integrated circuits, their cost demands the utmost in care. Before opening and/or installing any MOS integrated circuits you should ground your body and all metallic tools coming into contact with the leads, thru a 1 M ohm 1/4 watt resistor (supplied with the MP-A kit). The ground must be an "earth" ground such as a water pipe and not the circuit board ground. As for the connection to your body, attach a clip lead to your watch or metal ID bracelet. Make absolutely sure you have the 1 Meg ohm resistor connected between you and the "earth" ground, otherwise you will be creating a dangerous shock hazard. Avoid touching the leads of the integrated circuits any more than necessary when installing them, even if you are grounded. On those MOS IC's being soldered in place; the tip of the soldering iron should be grounded as well (separately from your body ground) either with or without a 1 Meg ohm resistor. Most soldering irons having a three prong line cord plug already have a grounded tip. Static electricity should be an important consideration in cold, dry environments. It is less of a problem when it is warm and humid.

When installing integrated circuits IC1 and IC2 into the zero force sockets on the MP-A Microprocessor/System board as shown in the pictures in the System Checkout Instructions you must exercise extreme care. Before inserting either of the integrated circuits into the sockets, snap and unsnap each zero force IC socket at least twice to loosen the pins. Before inserting the integrated circuits into their sockets, carefully bend their leads so they will slide easily into the sockets using a pair of long noise pliers grounded thru a one meg ohm resistor. When pressing the IC's into place, apply only light pressure as shown in Step 3 of the pictures. Heavier pressure required to lock each end of the socket should be applied to the exposed white plastic ends of the carrier (pointed to by the pen in the lower left-hand picutre in the System Checkout Instructions) using a common blade screwdriver.

( ) Install MOS integrated circuits IC1 and IC2 of the MP-A Microprocessor/System board into the integrated circuit sockets following the precautions outlined in the preceeding note. Orient the integrated circuits so the "dot" or notch on the package matches with that shown in the board's component layout drawing. Insert the integrated circuits following the instructions and diagrams shown in figure 1 of this instruction set. Install IC2 first and then IC1. Be very careful! IC1 is very expensive.

( ) Re-insert the MP-A Microprocessor/System board onto the mother board.

( ) Plug your terminal device onto the I/O connector along the "TOP" edge of the MP-C Serial Control Interface board. The terminal and MP-C board should already have been configured for one another as detailed in the MP-C Serial Control Interface instructions.

( ) Apply AC power to the terminal, for CT-1024 customers, you should have the CT-E screen read function (if applicable) turned off and have the CT-S serial interface RECEIVE ON/OFF turned ON, the TRANSMIT ON/OFF turned ON and the ECHO ON/OFF turned OFF.

( ) Apply AC power to the computer system.

If you were lucky, the computer should have come back with a carriage return, line feed and a "*" displayed on the terminal. This is due to the power-up restart circuit on the board. If you system did not do this, then depress the manual RESET button on the front panel. Each time the button is depressed the computer should send a carriage return, line feed and "*" to the terminal.

If the terminal's cursor moves any at all, printing anything, especially question marks, there is a good chance the computer is working and your problem is not having the terminal's parity, bit format, or baud rate configured correctly.

If there is no cursor movement, using GND as a reference, look at the output of IC1 pin 2 on the MP-C Serial Control Interface with an oscillioscope. Each time the RESET switch is depressed you should see the transmitted bit train of pulses (serialized CR, LF and "*") come out this pin. If you do, then you should be able to trace the signal to the output connector of the MP-C interface, where if still present indicates a problem with the terminal or its connections to the computer. If you do not see the bit train coming out of IC1 pin 2, then your problem is probably somewhere within the computer system.

Final Chassis Assembly

After you have installed and checked all of the boards within the system including of course the MP-M memory board(s) and optional interface cards you should complete the chassis assembly.

( ) Unplug the unit.

( ) Attach the front and rear panels to the chassis base plate using #6 - 32 x 1/4" screws, lockwashers and nuts. Orient the rear panel so the four large holes are directly behind the interface card slots. The line card should be brought out the hole directly behind the power transformer.

( ) Snap the five large palstic bushings into the rear panel from the outside of the panel.

( ) Route any interface I/O cables thru the large holes in the rear panel.

( ) You should have 5 wire ties left over from the MP-P assembly. Distribute them anywhere necessary to keep the wiring in neat bundles.

( ) Snap the tinnerman clips over the holes on the front and rear panel edges.

( ) Set the cover over the unit, tucking the lower edge on each end inside the chassis base plate.

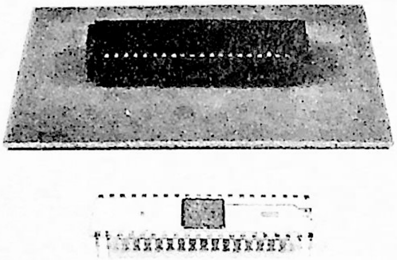
( ) Position the cover so its holes align with those on the front and rear panels.

( ) Place the metal trim strips around the front and rear panels sandwiching the cover between the trim strip and panel. Secure with #6 - 32 x 3/8" screws.

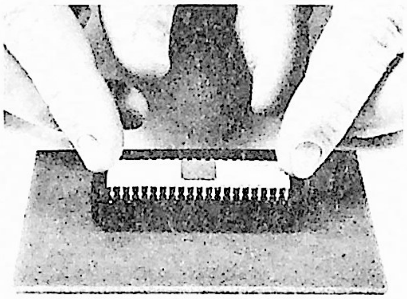
In Case of Problems

Due to the complexity of the system, it is very difficult to troubleshoot, even if you have the proper equipment. The best suggestion is to remove power and recheck the entire assembly procedure for each of the boards within the system. Check all of the boards with a magnifying glass if necessary for incomplete etching, solder "bridges" and foil conductor "breaks". These problems are much more likely than component failure. If you cannot find the problem we do have repair services available for the unit to those customers who have purchased the system boards including parts. We cannot repair those units where the customer has bought the boards only and has supplied his own components.

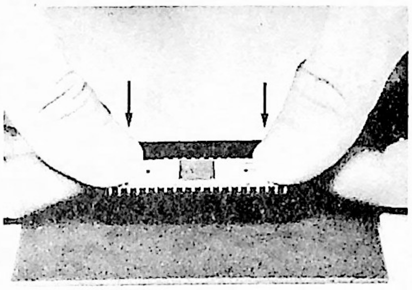
Insert the integrated circuits into the Molex Zero Force Sockets as outlined in the steps below.



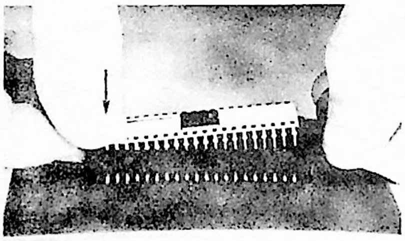
Step 1
The chip is loaded into the Molex Force Socket by ...



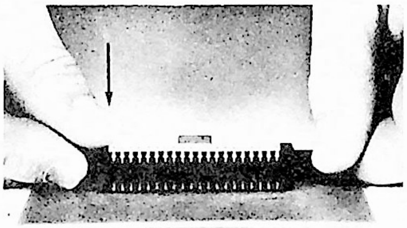
Step 2
... first placing the chip with index fingers into the insertion position. A forty position chip is shown for demonstration.



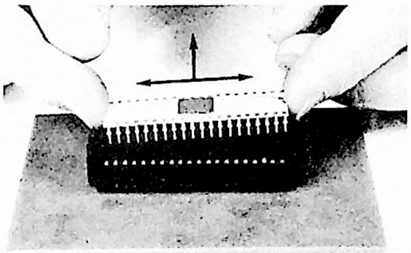
Step 3
The chip is inserted by applying simultaneous pressure at each end with the thumbs. There will be an obvious click when the chip is completely seated and in position. The click is the result of the holding tab snapping into the locked position.



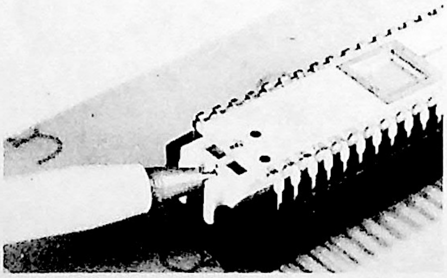
Step 4
Unloading the chip is a simple operation. Holding down (as demonstrated) one side of the chip, with the thumb, simply snap back the holding tab with the other thumbnail. (You may use a pointed tool in place of thumbnail.) This pops the chip up on the other side.



Step 5
Next repeat Step 4 by holding down lightly the released side of the chip with the thumb. (Take care not to apply too much pressure because the chip could be locked again on that side.) Then snap the holding tab to release the locked side of the chip. Note: Repeat Steps 4 and 5 if necessary to fully release the chip.



Step 6
The MOS/LSI chip can now be lifted quite easily from the Molex Zero Force Socket. Use index fingers as shown to lift straight up or use a slight end to end motion. Repeated insertion and withdrawals can be accomplished by repeating Steps 1-6.



If the chip cannot be removed as shown, a pointed object such as a ball point pen will do the job. Insert the pen point at either end of the socket and with a small amount of pressure the chip will pop up and can be removed.

molex

Assembly Instructions MP-B Mother Board

Introduction

The MP-B Mother Board is a 9" x 14" doubled sided plated thru hole board onto which all of the various processor boards are plugged. Provisions have been made for one MP-A Microprocessor/System board, up to four MP-M 4,096 word memory boards plus two unused slots. This gives the user the ability to handle up to 16,384 words of memory. For those demanding even more memory, the 50 line buss may be paralleled onto another MP-B Mother Board with power supply expanding the system to a maximum of 32,768 words of random access memory.

The mother board also provides the line buffering and address decoding for up to eight interface boards. Although one of the eight must be the control interface (serial), MP-C, the other seven may be any combination of serial (MP-S) and parallel (MP-L) interfaces the user may choose to have. For those demanding even more interfaces the 50 line processor buss may be paralleled onto another MP-B Mother Board with power supply expanding the interfacing to one control interface (serial), MP-C, plus any combination of up to fifteen serial (MP-S) and parallel (MP-L) interfaces.

When the SWTPC 6800 Computer System is being assembled, work on only one board at a time. Each of the system's boards and their associated parts must not be intermixed to avoid confusion during assembly.

PC Board Assembly

NOTE: Since all of the holes on the PC board have been plated thru, it is only necessary to solder the components from the bottom side of the board. The plating provides the electrical connection from the "BOTTOM" to the "TOP" foil of each hole. Unless otherwise noted it is important that none of the connections be soldered until all of the components of each group have been installed on the board. This makes it much easier to interchange components if a mistake is made during assembly. Be sure to use a low wattage iron (not a gun) with a small tip. Do not use acid core solder or any type of paste flux. We will not guarantee or repair any kit on which either product has been used. Use only the solder supplied with the kit or a 60/40 alloy resin core equivalent. Remember all of the connections are soldered on the bottom side of the board only. The plated-thru holes provide the electrical connection to the top foil.

( ) Before installing any parts on the circuit board, check both sides of the board over carefully for incomplete etching and foil "bridges" or "breaks. It is unlikely that you will find any but should there be one especially on the "TOP" side of the board it will be very hard to locate and correct after all of the components have been installed on the board.

( ) Attach all of the resistors to the board. As with all other components unless noted, use the parts list and component layout drawing to locate each part and install from the "TOP" side of the board bending the leads along the "BOTTOM" side of the board and trimming so that 1/16" to 1/8" of wire remains. Solder.

(✓) Install all of the capacitors on the board. Solder.

(✓) Install each of the 59, 10 pin Molex male connectors oriented so the shorter pinned side fits into the holes provided on the mother board. These connectors must be inserted from the "TOP" side of the board and must be pressed down firmly against the board. Make sure the body of the connector seats firmly against the circuit board and that each pin extends completely into the holes on the circuit board. Not being careful here will cause the plug-on boards to be less rigid. Do not solder the pins adjacent the dotted lines shown in the component layout drawing. It is suggested that you solder only the two end pins of each of the fifty nine connectors until all have been installed at which time if everything looks straight and rigid you should solder the as yet unsoldered pins still excluding the ones adjacent the dotted lines on the component layout drawing.

(✓) Using a pair of wire cutters, cut off the "INDEX" pin on each of the seven main board and eight interface board male connector strips. Each row is pointed out by the word "INDEX" printed right on the "TOP" side of the mother board. Be very careful when doing this. Do not cut off anything other than the "INDEX" pins. You cannot afford to make a mistake here. These "INDEX" locations prevent the various plug-on boards from being plugged on incorrectly later during assembly.

(✓) Install each of the integrated circuits excluding IC2. As each one is installed make sure it is down firmly against the board and solder only two of the leads to hole the pack in place while the other IC's are being inserted. Be very careful to install each in its correct position. Do not bend the leads on the back side of the board. Doing so makes it very difficult to remove the intergrated circuits should replacement ever be necessary. The semicircle notch or dot on the end of the package is used for orientation purposes and must match with the outlines shown on the component layout drawing for each of the IC's. After inserting all of the integrated circuits go back and solder each of the as yet unsoldered pins.

(✓) Install integrated circuit IC2 on the circuit board. This component must be oriented so its metal face is facing the circuit board with the small metal heatsink sandwiched between the two. The heatsink and IC are secured to the circuit board with a #4 - 40 x 3/8" screw, lockwasher and nut. The three leads of the integrated circuit must be bent down into each of their respective holes and the heatsink must be orientated as shown in the component layout drawing. Solder.

(✓) Remove any oxidation from the copper on the two mother board support strips using a piece of Scotchbrite®. Take the shorter of the two and position it on the "BOTTOM" side of the mother board along the main board GND buss and perpindicular to the mother board as indicated in the component layout drawing. It should be oriented with it's copper edges against the "BOTTOM" side of the mother board, extending from the first to the seventh main board connection rows. Solder the as yet unsoldered connector pins adjacent the strip making sure the strip is soldered in place as well. Make sure the strip remains firmly against the PC board while soldering. Now take the longer of the two strips and position it against the "BOTTOM" side of the mother board parallel to and in the center of the +8 UNR interface buss as indicated in the component layout drawing and attach like the first strip. These strips provide rigidity and support for the mother board and prevent the mother board from bottoming out when the plug-on boards are installed.

(✓) Working from the "TOP" side of the circuit board, fill in all of the feed-thru's with molten solder. The feed-thru's are those unused holes on the board whose internal plating connects the "TOP" and "BOTTOM" circuit connections. Filling these feed-thru's with molten solder guarantees the integrity of the connections and increases the current handling capability. Do not fill in the 16 holes on the edge of the board that are to be used for wiring connections.

(✓) Now that all of the components have been installed on the board, double check to make sure all have been installed correctly in their proper location.

(✓) Check very carefully to make sure that all connections have been soldered. It is very easy to miss some connections when soldering which can really cause some hard to find problems later during checkout. Also look for solder "bridges" and "cold" solder joints which are another common problem.

This completes the assembly phase for the MP-B board. Checkout instructions for the board are provided with the System Checkout Instructions supplied with this kit. The System Checkout Instructions are used after having assembled the MP-A Microprocessor/System Board, MP-B mother board, MC-C serial control interface, and the MP-P power supply.

How It Works

The only circuitry on the MP-B Mother board is that tying the various interface cards to the system's interface information buss. IC1 is a non-inverting buffer used to drive selected control lines feeding the interface cards. One of eight decoders IC3 and IC6 decode and enable one of eight interface cards when one of the interface addresses is loaded to the 50 line system information buss.

Since the eight bit data buss for the main boards as well as the interface cards is bi-directional, bi-directional transceiver buffers IC7 and IC8 buffer the incoming and outgoing data to and from the interface data buss to the system's data buss. Gates within NAND gate IC4 and NOR gate IC5 control the direction of data flow within the transceiver/buffers. +5 VDC power for the interface decode/buffer circuitry is provided by voltage regulator IC2. +5 VDC power for all of the plug-on boards, including interfaces is provided by separate regulators on each board.

The following is a brief description of each of the fifty lines on the system information buss:

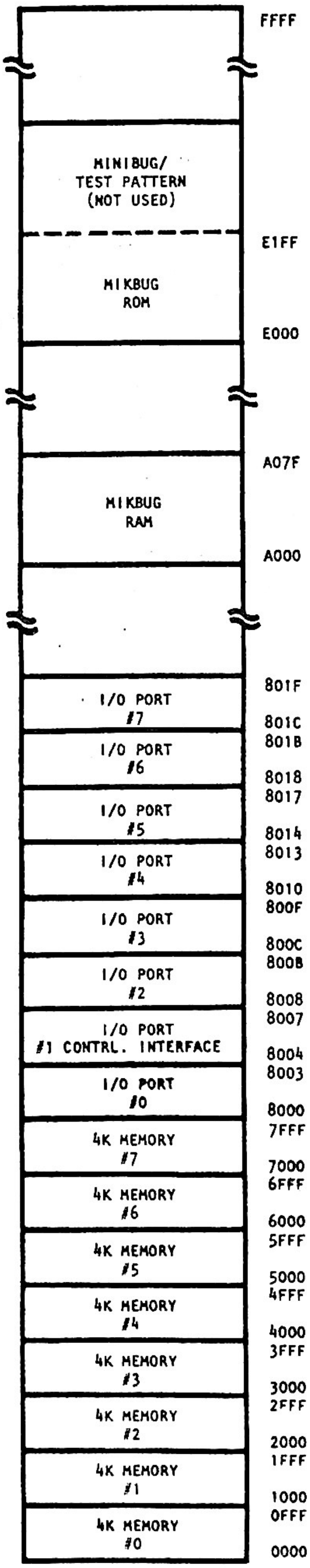
$\overline{D0}$ - $\overline{D7}$ The $\overline{D0}$ - $\overline{D7}$ lines carry inverted data bits 0 thru 7 respectively forming 8 bit data words which are exchanged between the various

	boards within the system.
A0 - A15	The A0 - A15 lines carry address bits 0 thru 15 respectively forming a 16 bit address which is used to define either a memory location or interface address.
GND	The GND line is the system's common of power supply ground point.
7 - 8 VDC UNREG OR +8 UNR	The 7 - 8 VDC UNREG point is the line to which a +7 to 8 volt DC @10 A unregulated power supply should be attached. This voltage is then regulated down to +5 VDC by independent regulators on the various boards within the system.
-12, +12	The -12 and +12 points are lines to which an isolated ground -12 @200 Ma and +12 @200 Ma power supply should be connected. The voltages are necessary for generating the currents required by 20 Ma current loop and RS-232 equipment on the MP-C control and MP-S serial interfaces.
INDEX	The INDEX is an unused one and is provided so the pin on each of the male connectors may be cut with the corresponding female connector pins plugged, preventing the circuit boards from being plugged on incorrectly.
M. RESET	The MANUAL RESET line when momentarily grounded indirectly resets the registers internal to the processor and interfaces, and loads the ROM stored mini-operating system. This line is normally grounded by depressing the RESET button on the system's front panel.
$\overline{NMI}$	The $\overline{NMI}$ is the non-maskable, single level interrupt line feeding the processor board. When momentarily grounded it forces the processor into a push-down stack, store routine, followed by a program jump to a user selected address stored in the operating system RAM. The $\overline{NMI}$ is not maskable thus cannot be inhibited by the programmer thru software.
$\overline{IRQ}$	The $\overline{IRQ}$ is the maskable, single level interrupt request line feeding the processor board. If not inhibited by software it will when momentarily grounded force the processor into a push-down stack, store routine followed by a program jump to a user selected address stored in the operating system RAM.
UD1, UD2	The UD1 and UD2 are user defined lines and have not been assigned a function.
$\overline{\phi}_2$	$\overline{\phi}_2$ is one of the two complementary system clock outputs and is used to signal that valid data is on the data lines D0 - D7 when low.
$\overline{VMA}$	$\overline{VMA}$ is the valid memory address line which goes low to confirm that valid memory data is being presented on the sixteen address lines, A0 - A15.
R/$\overline{W}$	The READ/$\overline{\text{WRITE}}$ line establishes the direction of data flow on the

the eight data lines, $\overline{D0}$ - $\overline{D7}$. It is high for a read from memory or interface and is low for a write to memory or interface.

$\overline{\text{RESET}}$	The $\overline{\text{RESET}}$ line when low resets the registers internal to the processor and interfaces, and loads the ROM stored mini-operating system. This line is activated by a one shot on the Microprocessor/System board when the system is first powered up or when M. RESET line is momentarily grounded.
BA	The BUS AVAILABLE line goes high acknowledging a processor halt meaning the processor has stopped and that the system information bus is available for external control.
$\overline{\text{HALT}}$	The normally high $\overline{\text{HALT}}$ line when brought low halts the processor and frees the system information buss for external control.
ϕ_1	ϕ_1 is the non-overlapping clock complement of ϕ_2.
110b,150b 300b,600b 1200b	These five lines carry the clocks required by the serial interfaces for 110, 150, 300, 600 and 1200 baud communication.

Attached to the 50 line system information buss are the interface decode and driver circuits. A considerable cost savings is made by providing the address decoding and information buss buffering for all of the interfaces right on the mother board instead of providing it on each of the interface boards individually. Since each of the parallel interfaces require four address locations and the serial two, four addresses are provided for each of the interface positions. They are assigned as shown in the memory map, figure 1. Interface position 1 (8004 - 8007) is reserved for the terminal, control interface. The signals carried on the interface information buss are almost idential to those on the system buss. UD3 and UD4 are here again User Defined data lines and RS0 and RS1 are Register select lines which are identical to address line A0 and A1 respectively.


FFFF
MINIBUG/
TEST PATTERN
(NOT USED)
E1FF
MIKBUG
ROM
E000
A07F
MIKBUG
RAM
A000
801F
I/O PORT
#7
801C
801B
I/O PORT
#6
8018
8017
I/O PORT
#5
8014
8013
I/O PORT
#4
8010
800F
I/O PORT
#3
800C
800B
I/O PORT
#2
8008
8007
I/O PORT
#1 CONTRL. INTERFACE
8004
8003
I/O PORT
#0
8000
7FFF
4K MEMORY
#7
7000
6FFF
4K MEMORY
#6
6000
5FFF
4K MEMORY
#5
5000
4FFF
4K MEMORY
#4
4000
3FFF
4K MEMORY
#3
3000
2FFF
4K MEMORY
#2
2000
1FFF
4K MEMORY
#1
1000
0FFF
4K MEMORY
#0
0000

All addresses are in hexadecimal

SwTPC 6800 Memory Map

Figure 1

Parts List MP-B Mother Board

Resistors

R1 - R6, R10	470 ohm 1/4 watt resistor
R7, R8	6.8K ohm 1/4 watt resistor
R9, R11, R12	1K ohm 1/4 watt resistor

Capacitors

C1	0.1 mfd disc capacitor

Integrated Circuits

IC-1	DM8097 Tri-State Hex Buffer
IC-2	7805 +5 VDC Voltage Regulator
IC-3, IC-6	74S138 1 of 8 decoder
IC-4	7400 Quad NAND Gate
IC-5	7402 Quad NOR Gate
IC-7, IC-8	DM8835 Quad Bi-directional Transceiver

Assembly Instructions MP-A Microprocessor/System Board

Introduction

The MP-A board is the primary logic board for the system. It is a 5 1/2" x 9" double sided plated thru hole circuit board containing the 6800 microprocessor chip, the 6830 ROM which stores the Mini-Operating system and the 6810 128 byte scratch pad memory for the ROM. There is a crystal controlled processor clock driver and baud rate generator providing serial interface baud rates of 110, 150, 300, 600 and 1200 baud for all but the control interface which is operable at 110 or 300 baud. The board also contains a power up/manual reset circuit which loads the ROM stored operating system when activated. Full I/O buffering is provided for the 16 address lines and 8 bi-directional data lines with these and other inter-connections made to the rest of the system thru a fifty pin connector to the mother board (MP-B). +5 volt power for the board is supplied by an on board +5 volt regulator with heatsink at a total current consumption of 0.8 A typical.

When the SWTPC 6800 Computer System is being assembled, work on only one board at a time. Each of the sytem's boards and their associated parts must not be intermixed to avoid confusion during assembly. The MOS integrated circuits supplied with this kit are susceptible to static electricity damage and for this reason have been packed with their leads impressed onto a special conductive foam or possibly wrapped in a conductive foil. In either case, do not remove the protective material until specifically told to do so later in the instructions.

PC Board Assembly

NOTE: Since all of the holes on the PC board have been plated thru, it is only necessary to solder the components from the bottom side of the board. The plating provides the electrical connection from the "BOTTOM" to the "TOP" foil of each hole. Unless otherwise noted it is important that none of the connections be soldered until all of the components of each group have been installed on the board. This makes it much easier to interchange components if a mistake is made during assembly. Be sure to use a low wattage iron (not a gun) with a small tip. Do not use acid core solder or any type of paste flux. We will not guarantee or repair any kit on which either product has been used. Use only the solder supplied with the kit or a 60/40 alloy resin core equivalent. Remember all of the connections are soldered on the bottom side of the board only. The plated-thru holes provide the electrical connection to the top foil.

(✓) Before installing any parts on the circuit board, check both sides of the board over carefully for incomplete etching and foil "bridges" or "breaks" It is unlikely that you will find any but should there be one especially on the "TOP" side of the board it will be very hard to locate and correct after all of the components have been installed on the board.

(✓) Attach all of the resistors to the board. As with all other components unless noted, use the parts list and component layout drawing to locate each part and install from the "TOP" side of the board bending the leads along the "BOTTOM" side of the board and trimming so that 1/16" to 1/8" of wire remains. Solder. You should have one 1M ohm resistor left over.

( ) Install all of the capacitors on the board. Be sure to orient the electrolytic capacitors correctly. The polarity is indicated on the component layout drawing. Solder.

(✓) Install the transistors on the board. The transistors must be turned to match the outlines on the component layout drawing. Solder.

(✓) Attach crystal XTAL1 to the circuit board. It should be oriented so its length lies flat across the circuit board as shown in the outline on the component layout drawing. If the crystal has long thin wire leads, they may be bent down 90 degress at the base of the crystal so they fit into the two holes provided for the crystal on the circuit board. If the crystal has short heavy wire leads, solder onto and at a 90 degree angle, the crystal's leads some heavy buss wire. The buss wire with the crystal attached may then be inserted into the board. In either case the crystal must be attached so its metal case could never inadvertantly come into contact with either the foil on the circuit board or either one of its own two leads. Solder.

(✓) Starting from one end of the circuit board install each of the five, 10 pin Molex female edge connectors along the lower edge of the board. These connectors must be inserted from the "TOP" side of the board and must be pressed down firmly against the board. Make sure the body of the connector seats firmly against the circuit board and that each pin extends completely into the holes on the circuit board. Not being careful here will cause the board to either wobble and/or be crooked when plugged onto the mother board. It is suggested that you solder only the two end pins of each of the five connectors until all have been installed at which time if everything looks straight and rigid you should solder the as yet unsoldered pins.

(✓) Insert the small nylon indexing plug into the edge connector pin indicated by the small triangular arrow on the "BOTTOM" side of the circuit board. This prevents the board from being accidentally plugged onto the mother board incorrectly.

( ) Install integrated circuits IC5 thru IC16 and IC18 thru IC20. As each one is installed make sure it is down firmly against the board and solder only two of the leads to hold the pack in place while the other IC's are being inserted. Be very careful to install each in its correct position. Do not bend the leads on the back side of the board. Doing so makes it very difficult to remove the integrated circuits should replacement ever be necessary. The semicircle notch or dot on the end of the package is used for orientation purposes and must match with the outlines shown on the component layout drawing for each of the IC's. After inserting all of the integrated circuits go back and solder each of the as yet unsoldered pins.

(✓) Install integrated circuit IC17 on the circuit board. This component must be oriented so its metal face is facing the circuit board with the small metal heatsink sandwiched between the two. The heatsink and IC are secured to the circuit board with a #4-40 x 1/4" screw, lockwasher and nut. The three leads of the integrated circuit must be bent down into each of their respective holes and trimmed, and the heatsink must be oriented as shown in the component layout drawing. Solder.

(✓) Attach the two zero force integrated circuit sockets to the board in the IC1 and IC2 positions only. The 40 pin socket goes in the IC1 position while the 24 pin socket goes in the IC2 position. Orient each socket so the corner having the projecting tab is adjacent the pin indicated by the "dot" within the integrated circuit outline on the component layout drawing. Solder.

NOTE: MOS integrated circuits are susceptable to damage by static electricity. Although some degree of protection is provided internally within the integrated circuits, their cost demands the utmost in care. Before opening and/or installing any MOS integrated circuits you should ground your body and all metallic tools coming into contact with the leads, thru a 1 M ohm 1/4 watt resistor (supplied with the kit). The ground must be an "earth" ground such as a water pipe, and not the circuit board ground. As for the connection to your body, attach a clip lead to your watch or metal ID bracelet. Make absolutely sure you have the 1 Meg ohm resistor connected between you and the "earth" ground, otherwise you will be creating a dangerous shock hazard. Avoid touching the leads of the integrated circuits any more than necessary when installing them, even if you are grounded. On those MOS IC's being soldered in place; the tip of the soldering iron should be grounded as well (separately from your body ground) either with or without a 1 Meg ohm resistor. Most soldering irons having a three prong line cord plug already have a grounded tip. Static electricity should be an important consideration in cold, dry environments. It is less of a problem when it is warm and humid.

( ) Install MOS integrated circuits IC3 and IC4 following the precautions given in the preceding section. As each is installed, make sure it is down firmly against the board before soldering all of its leads. Be very careful to install each in its correct position. Do not bend the leads on the back side of the board. Doing so makes it very difficult to remove the integrated circuits should replacement ever be necessary. The "dot" on the end of the package is used for orientation purposes and must match with that shown on the component layout drawing for each of the IC's.

( ) Working from the "TOP" side of the circuit board, fill in all of the feed-thru's with molten solder. The feed-thru's are those unused holes on the board whose internal plating connects the "TOP" and "BOTTOM" circuit connections. Filling these feed-thru's with molten solder guarantees the integrity of the connections and increases the current handling capability.

( ) Now that most of the components have been installed on the board, double check to make sure all have been installed correctly in their proper location.

( ) Check very carefully to make sure that all connections have been soldered. It is very easy to miss some connections when soldering which can really cause some hard to find problems later during check out. Also look for solder "bridges" and "cold" solder joints which are another common problem.

This completes the assembly phase for the MP-A board. Integrated circuits IC1 and IC2 should not be installed until the board goes thru a preliminary checkout detailed in the System Checkout Instructions supplied with the MP-B mother board kit. The System Checkout Instruction are used after having assembled the MP-A Microprocessor/System Board, MP-B mother board, MP-C serial, control interface, and the MP-P power supply.

Since the MP-A circuit board now contains MOS devices it is susceptable to damage from severe static electrical sources. One should avoid handling the board any more than necessary and when you must, avoid touching or allowing anything to come into contact with any of the conductors on the board.

How It Works

The entire 6800 Computer System is built around IC1, the 6800 Microprocessor Unit (MPU). Most of the components within the system are used to provide the clocks, buffering and decoding necessary to interface to this integrated circuit. Complete details of the operation and specifications of IC1 are contained in the 6800 Hardware section of the System Documentation Notebook and will not be repeated here.

Integrated circuit IC2 is a 1024 x 8 bit read only memory (ROM) which permanently stores the computer's mini-operating system described in the Operating System section of the System Documentation Notebook. Whenever the computer system is first powered up or when the front panel RESET switch is depressed the computer jumps to this operating system firmware (programming stored in ROM) which gives the user terminal control. Since the mini-operating system uses only 512 words of the ROM, the upper 512 words have been disabled from access and the ROM operating system addresses have been located from E000 to E1FF inclusive.

The ROM stored mini-operating requires a small amount of random access memory (RAM) for operation. It uses IC3, a 128 x 8 bit static memory. What is nice here is that a large portion of the RAM memory addresses are unassigned which means many short programs such as the diagnostics can be loaded right into the operating system RAM without using any of the large MP-M static memory cards. Complete information regarding the unassigned RAM locations is contained in the Operating System section of the System Documentation Notebook.

IC4 is the crystal controlled clock/baud rate generator. It produces the five baud rate clock frequencies required by the control and serial interfaces. It also generates a clock which is divided by two by half of IC20, split into two non-overlapping phases by IC18 and IC19 buffered by transistors Q1 thru Q4 and sent onto IC1, the MPU chip. IC14 provides the buffering for each of the used outputs on baud rate generator IC4.

Timer integrated circuit IC11 is responsible for generating the power up/ manual pushbutton RESET which loads the mini-operating system stored in the ROM, IC2.

Half of D flip flop, IC20 is used for timed halting of the processor in direct memory access (DMA) applications.

Integrated circuits IC5, IC6 and IC7 are used as non-inverting address line buffers for each of the sixteen address lines. Integrated circuits IC8 and IC9 are inverting bi-directional transceiver buffers for the system's eight bi-directional data lines. The gates feeding the enable lines of the transceiver IC's guarantee the appropiate receive or transmit data buss buffers are enabled at the proper time.

+5 VDC power for the board is supplied by voltage regulator IC17.

Parts List MP-A Microprocessor/System Board

Resistors

R1, R2, R4	1M ohm 1/4 watt resistor
R3, R7, R12, R13	10K " " " "
R5, R6	6.8K " " " "
R8, R9, R19	1K " " " "
R10, R11	4.7K " " " "
R14, R17	10 " " " "
R15, R16	22 " " " "
R18	470 " " " "

Capacitors

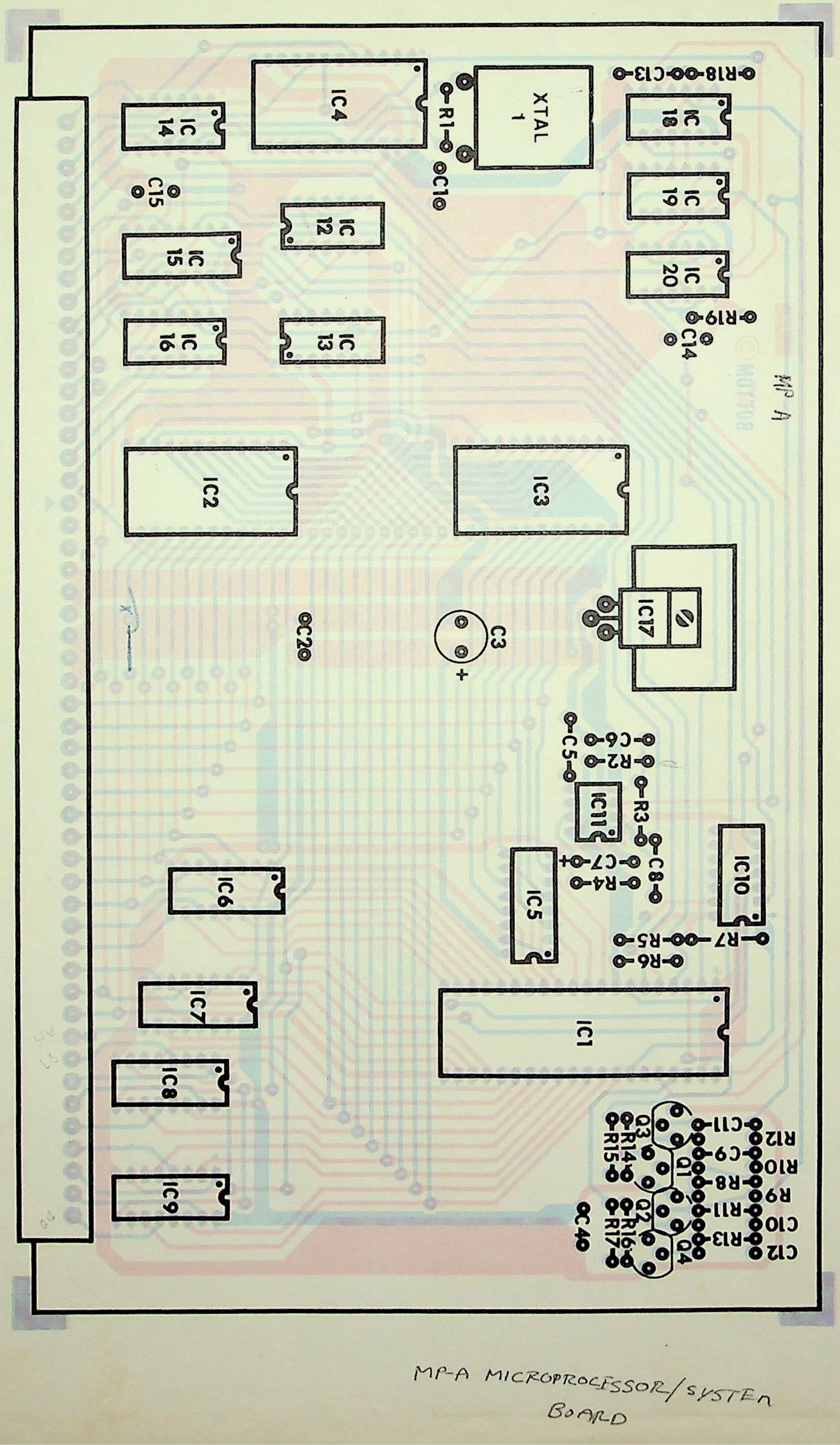
C1, C2, C4, C14, C15	0.1 mfd disc. capacitor
C3	100 mfd @15 VDC electrolytic capacitor
C5	0.01 mfd mylar capacitor
C6	0.1 mfd mylar capacitor
C7	0.47 mfd tantalum capacitor
C8	→ 1000 pF polystyrene capacitor
C9, C10	33 pfd polysytrene capacitor
C11, C12	120 pfd polystyrene capacitor
C13	1000 pfd polystyrene capacitor

Semiconductors

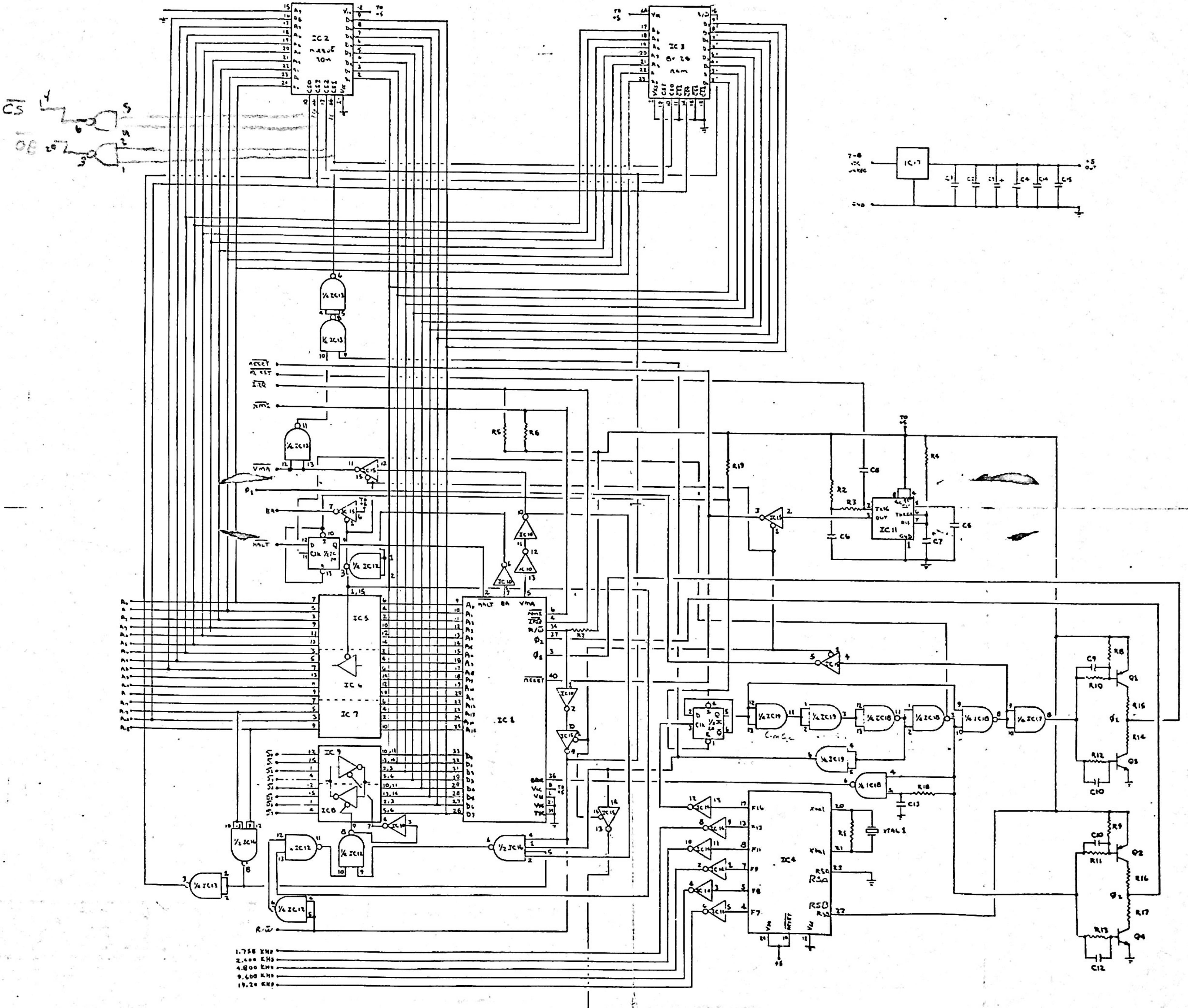
IC-1	MC6800 MPU (MOS)
IC-2	MC6830L7 ROM (MOS)
IC-3	MC6810L-1 RAM (MOS)
IC-4	MC14411 Baud Rate Generator (MOS)
IC-5, IC-6, IC-7	DM8097 Hex Tri-State Buffer
IC-8, IC-9	DM8835 Quad Bi-directional Transceiver
IC-10	7404 Hex Inverter
IC-11	555 or 1455 Timer
IC-12, IC-13	7400 Quad NAND gate
IC-14	74L04 HP Hex Inverter
IC-15	DM8098 Hex Tri-State Buffer
IC-16	7420 Dual 4-Input NAND Gate
IC-17	7805 +5 VDC Voltage Regulator
IC-18	74H00 HS Quad NAND Gate
IC-19	74H08 HS Quad AND Gate
IC-20	7474 Dual "D" Flip-Flop
Q1, Q2	2N5087 transistor
Q3, Q4	2N5210 transistor

Misc.

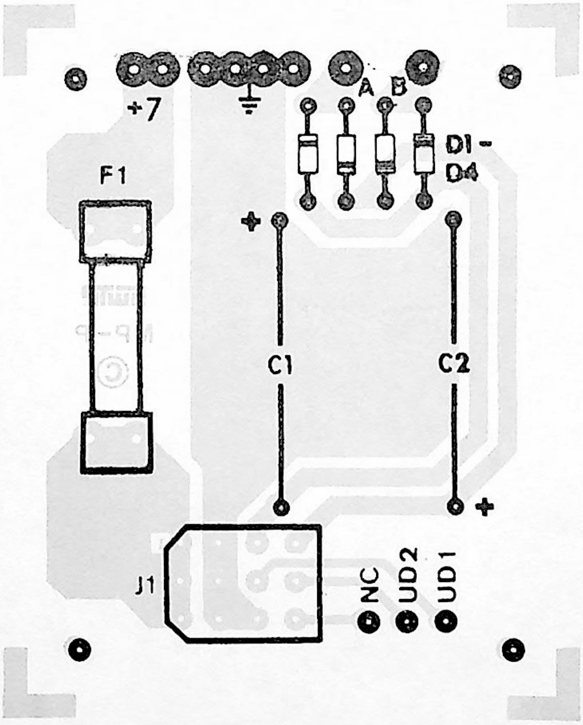
XTAL 1	1.7971 MHz Parallel Resonant Crystal


IC1
IC2
IC3
IC4
IC5
IC6
IC7
IC8
IC9
IC10
IC11
IC 12
IC 13
IC 14
IC 15
IC 16
IC17
IC 18
IC 19
IC 20
XTAL 1
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
C1
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
C14
C15
C20
Q1
Q2
Q3
Q4
+
MP A

MP-A MICROPROCESSOR/SYSTEM BOARD


IC 2
ROM
IC 3
RAM
IC 1
IC 4
IC 5
IC 6
IC 7
IC 8
IC 9
IC 11
IC 17
CS
OE
RESET
IRQ
NMI
VMA
φ1
φ2
BA
HALT
R/W
1.758 KHz
2.400 KHz
4.800 KHz
9.600 KHz
19.20 KHz
XTAL 1
+5 OUT
GND
Q1
Q2
Q3
Q4

Schematic - MP-A Microprocessor/System Board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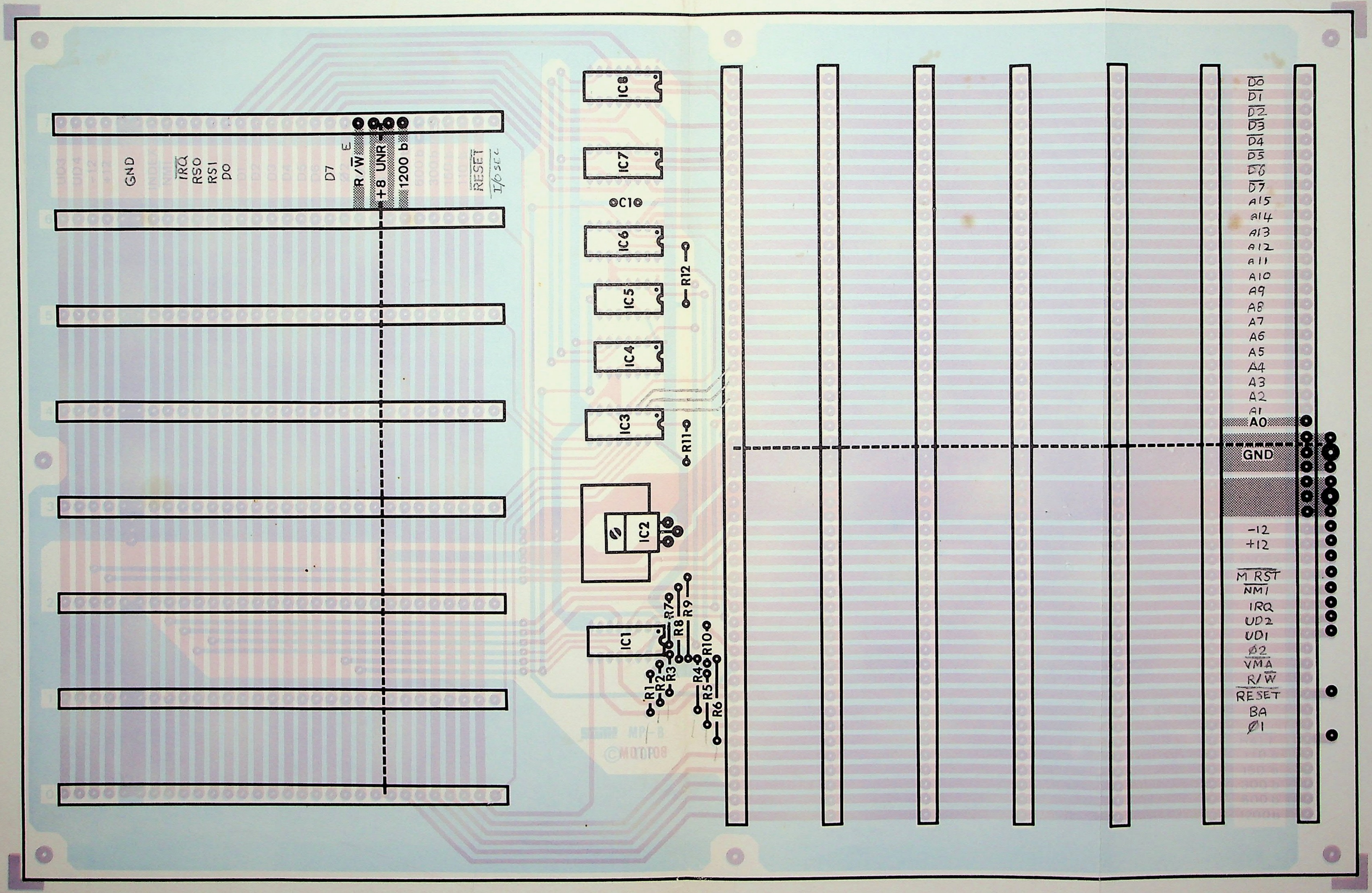
A
B
D1-
D4
F1
+
C1
C2
+
J1
NC
UD2
UD1


GND
IRQ
RS0
RS1
D0
D7
E
R/W
+8 UNR
1200 b
RESET
I/O SEL
IC8
IC7
C1
IC6
R12
IC5
IC4
IC3
R11
IC2
IC1
R7
R8
R9
R10
R1
R2
R3
R4
R5
R6
D0
D1
D2
D3
D4
D5
D6
D7
A15
A14
A13
A12
A11
A10
A9
A8
A7
A6
A5
A4
A3
A2
A1
A0
GND
-12
+12
M RST
NMI
IRQ
UD2
UD1
Ø2
VMA
R/W
RESET
BA
Ø1

Assembly Instructions MP-B Mother Board

Introduction

The MP-B Mother Board is a 9" x 14" doubled sided plated thru hole board onto which all of the various processor boards are plugged. Provisions have been made for one MP-A Microprocessor/System board, up to four MP-M 4,096 word memory boards plus two unused slots. This gives the user the ability to handle up to 16,384 words of memory. For those demanding even more memory, the 50 line buss may be paralleled onto another MP-B Mother Board with power supply expanding the system to a maximum of 32,768 words of random access memory.

The mother board also provides the line buffering and address decoding for up to eight interface boards. Although one of the eight must be the control interface (serial), MP-C, the other seven may be any combination of serial (MP-S) and parallel (MP-L) interfaces the user may choose to have. For those demanding even more interfaces the 50 line processor buss may be paralleled onto another MP-B Mother Board with power supply expanding the interfacing to one control interface (serial), MP-C, plus any combination of up to fifteen serial (MP-S) and parallel (MP-L) interfaces.

When the SWTPC 6800 Computer System is being assembled, work on only one board at a time. Each of the system's boards and their associated parts must not be intermixed to avoid confusion during assembly.

PC Board Assembly

NOTE: Since all of the holes on the PC board have been plated thru, it is only necessary to solder the components from the bottom side of the board. The plating provides the electrical connection from the "BOTTOM" to the "TOP" foil of each hole. Unless otherwise noted it is important that none of the connections be soldered until all of the components of each group have been installed on the board. This makes it much easier to interchange components if a mistake is made during assembly. Be sure to use a low wattage iron (not a gun) with a small tip. Do not use acid core solder or any type of paste flux. We will not guarantee or repair any kit on which either product has been used. Use only the solder supplied with the kit or a 60/40 alloy resin core equivalent. Remember all of the connections are soldered on the bottom side of the board only. The plated-thru holes provide the electrical connection to the top foil.

( ) Before installing any parts on the circuit board, check both sides of the board over carefully for incomplete etching and foil "bridges" or "breaks. It is unlikely that you will find any but should there be one especially on the "TOP" side of the board it will be very hard to locate and correct after all of the components have been installed on the board.

( ) Attach all of the resistors to the board. As with all other components unless noted, use the parts list and component layout drawing to locate each part and install from the "TOP" side of the board bending the leads along the "BOTTOM" side of the board and trimming so that 1/16" to 1/8" of wire remains. Solder.

( ) Install all of the capacitors on the board. Solder.

( ) Install each of the 59, 10 pin Molex male connectors oriented so the shorter pinned side fits into the holes provided on the mother board. These connectors must be inserted from the "TOP" side of the board and must be pressed down firmly against the board. Make sure the body of the connector seats firmly against the circuit board and that each pin extends completely into the holes on the circuit board. Not being careful here will cause the plug-on boards to be less rigid. Do not solder the pins adjacent the dotted lines shown in the component layout drawing. It is suggested that you solder only the two end pins of each of the fifty nine connectors until all have been installed at which time if everything looks straight and rigid you should solder the as yet unsoldered pins still excluding the ones adjacent the dotted lines on the component layout drawing.

( ) Using a pair of wire cutters, cut off the "INDEX" pin on each of the seven main board and eight interface board male connector strips. Each row is pointed out by the word "INDEX" printed right on the "TOP" side of the mother board. Be very careful when doing this. Do not cut off anything other than the "INDEX" pins. You cannot afford to make a mistake here. These "INDEX" locations prevent the various plug-on boards from being plugged on incorrectly later during assembly.

( ) Install each of the integrated circuits excluding IC2. As each one is installed make sure it is down firmly against the board and solder only two of the leads to hole the pack in place while the other IC's are being inserted. Be very careful to install each in its correct position. Do not bend the leads on the back side of the board. Doing so makes it very difficult to remove the intergrated circuits should replacement ever be necessary. The semicircle notch or dot on the end of the package is used for orientation purposes and must match with the outlines shown on the component layout drawing for each of the IC's. After inserting all of the integrated circuits go back and solder each of the as yet unsoldered pins.

( ) Install integrated circuit IC2 on the circuit board. This component must be oriented so its metal face is facing the circuit board with the small metal heatsink sandwiched between the two. The heatsink and IC are secured to the circuit board with a #4 - 40 x 3/8" screw, lockwasher and nut. The three leads of the integrated circuit must be bent down into each of their respective holes and the heatsink must be orientated as shown in the component layout drawing. Solder.

( ) Remove any oxidation from the copper on the two mother board support strips using a piece of Scotchbrite®. Take the shorter of the two and position it on the "BOTTOM" side of the mother board along the main board GND buss and perpindicular to the mother board as indicated in the component layout drawing. It should be oriented with it's copper edges against the "BOTTOM" side of the mother board, extending from the first to the seventh main board connection rows. Solder the as yet unsoldered connector pins adjacent the strip making sure the strip is soldered in place as well. Make sure the strip remains firmly against the PC board while soldering. Now take the longer of the two strips and position it against the "BOTTOM" side of the mother board parallel to and in the center of the +8 UNR interface buss as indicated in the component layout drawing and attach like the first strip. These strips provide rigidity and support for the mother board and prevent the mother board from bottoming out when the plug-on boards are installed.

( ) Working from the "TOP" side of the circuit board, fill in all of the feed-thru's with molten solder. The feed-thru's are those unused holes on the board whose internal plating connects the "TOP" and "BOTTOM" circuit connections. Filling these feed-thru's with molten solder guarantees the integrity of the connections and increases the current handling capability. Do not fill in the 16 holes on the edge of the board that are to be used for wiring connections.

( ) Now that all of the components have been installed on the board, double check to make sure all have been installed correctly in their proper location.

( ) Check very carefully to make sure that all connections have been soldered. It is very easy to miss some connections when soldering which can really cause some hard to find problems later during checkout. Also look for solder "bridges" and "cold" solder joints which are another common problem.

This completes the assembly phase for the MP-B board. Checkout instructions for the board are provided with the System Checkout Instructions supplied with this kit. The System Checkout Instructions are used after having assembled the MP-A Microprocessor/System Board, MP-B mother board, MC-C serial control interface, and the MP-P power supply.

How It Works

The only circuitry on the MP-B Mother board is that tying the various interface cards to the system's interface information buss. IC1 is a non-inverting buffer used to drive selected control lines feeding the interface cards. One of eight decoders IC3 and IC6 decode and enable one of eight interface cards when one of the interface addresses is loaded to the 50 line system information buss.

Since the eight bit data buss for the main boards as well as the interface cards is bi-directional, bi-directional transceiver buffers IC7 and IC8 buffer the incoming and outgoing data to and from the interface data buss to the system's data buss. Gates within NAND gate IC4 and NOR gate IC5 control the direction of data flow within the transceiver/buffers. +5 VDC power for the interface decode/buffer circuitry is provided by voltage regulator IC2. +5 VDC power for all of the plug-on boards, including interfaces is provided by separate regulators on each board.

The following is a brief description of each of the fifty lines on the system information buss:

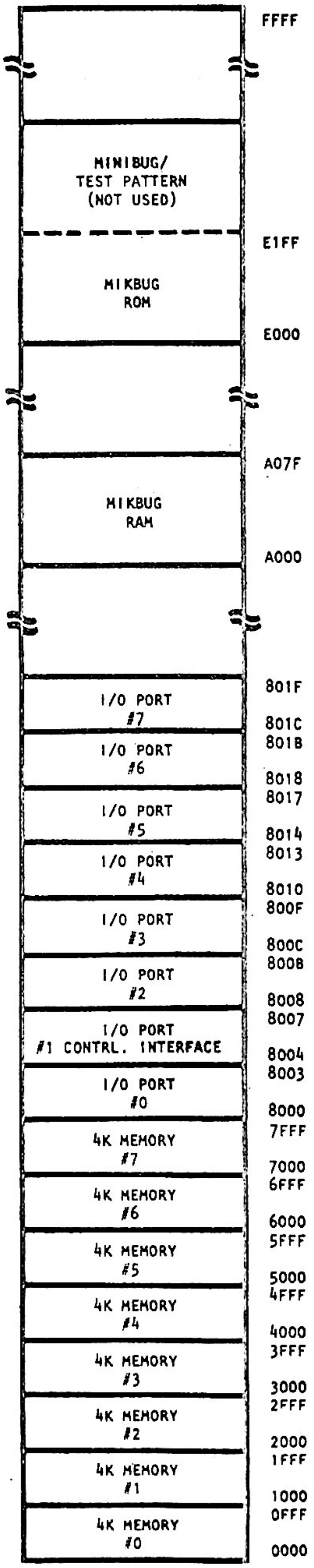
$\overline{D0}$ - $\overline{D7}$	The $\overline{D0}$ - $\overline{D7}$ lines carry inverted data bits 0 thru 7 respectively forming 8 bit data words which are exchanged between the various

boards within the system.

A0 - A15	The A0 - A15 lines carry address bits 0 thru 15 respectively forming a 16 bit address which is used to define either a memory location or interface address.
GND	The GND line is the system's common of power supply ground point.
7 - 8 VDC UNREG OR +8 UNR	The 7 - 8 VDC UNREG point is the line to which a +7 to 8 volt DC @10 A unregulated power supply should be attached. This voltage is then regulated down to +5 VDC by independent regulators on the various boards within the system.
-12, +12	The -12 and +12 points are lines to which an isolated ground -12 @200 Ma and +12 @200 Ma power supply should be connected. The voltages are necessary for generating the currents required by 20 Ma current loop and RS-232 equipment on the MP-C control and MP-S serial interfaces.
INDEX	The INDEX is an unused one and is provided so the pin on each of the male connectors may be cut with the corresponding female connector pins plugged, preventing the circuit boards from being plugged on incorrectly.
M. RESET	The MANUAL RESET line when momentarily grounded indirectly resets the registers internal to the processor and interfaces, and loads the ROM stored mini-operating system. This line is normally grounded by depressing the RESET button on the system's front panel.
$\overline{NMI}$	The $\overline{NMI}$ is the non-maskable, single level interrupt line feeding the processor board. When momentarily grounded it forces the processor into a push-down stack, store routine, followed by a program jump to a user selected address stored in the operating system RAM. The $\overline{NMI}$ is not maskable thus cannot be inhibited by the programmer thru software.
$\overline{IRQ}$	The $\overline{IRQ}$ is the maskable, single level interrupt request line feeding the processor board. If not inhibited by software it will when momentarily grounded force the processor into a push-down stack, store routine followed by a program jump to a user selected address stored in the operating system RAM.
UD1, UD2	The UD1 and UD2 are user defined lines and have not been assigned a function.
$\overline{\phi}_2$	$\overline{\phi}_2$ is one of the two complementary system clock outputs and is used to signal that valid data is on the data lines $\overline{D0}$ - $\overline{D7}$ when low.
$\overline{VMA}$	$\overline{VMA}$ is the valid memory address line which goes low to confirm that valid memory data is being presented on the sixteen address lines, A0 - A15.
$R/\overline{W}$	The $READ/\overline{WRITE}$ line establishes the direction of data flow on the

	the eight data lines, $\overline{D0}$ - $\overline{D7}$. It is high for a read from memory or interface and is low for a write to memory or interface.
$\overline{\text{RESET}}$	The $\overline{\text{RESET}}$ line when low resets the registers internal to the processor and interfaces, and loads the ROM stored mini-operating system. This line is activated by a one shot on the Microprocessor/ System board when the system is first powered up or when M. RESET line is momentarily grounded.
BA	The BUS AVAILABLE line goes high acknowledging a processor halt meaning the processor has stopped and that the system information bus is available for external control.
$\overline{\text{HALT}}$	The normally high $\overline{\text{HALT}}$ line when brought low halts the processor and frees the system information buss for external control.
ϕ_1	ϕ_1 is the non-overlapping clock complement of ϕ_2.
110b,150b 300b,600b 1200b	These five lines carry the clocks required by the serial interfaces for 110, 150, 300, 600 and 1200 baud communication.

Attached to the 50 line system information buss are the interface decode and driver circuits. A considerable cost savings is made by providing the address decoding and information buss buffering for all of the interfaces right on the mother board instead of providing it on each of the interface boards individually. Since each of the parallel interfaces require four address locations and the serial two, four addresses are provided for each of the interface positions. They are assigned as shown in the memory map, figure 1. Interface position 1 (8004 - 8007) is reserved for the terminal, control interface. The signals carried on the interface information buss are almost idential to those on the system buss. UD3 and UD4 are here again User Defined data lines and RS0 and RS1 are Register select lines which are identical to address line A0 and A1 respectively.


FFFF
MINIBUG/
TEST PATTERN
(NOT USED)
E1FF
MIKBUG
ROM
E000
A07F
MIKBUG
RAM
A000
801F
I/O PORT
#7
801C
801B
I/O PORT
#6
8018
8017
I/O PORT
#5
8014
8013
I/O PORT
#4
8010
800F
I/O PORT
#3
800C
800B
I/O PORT
#2
8008
8007
I/O PORT
#1 CONTRL. INTERFACE
8004
8003
I/O PORT
#0
8000
7FFF
4K MEMORY
#7
7000
6FFF
4K MEMORY
#6
6000
5FFF
4K MEMORY
#5
5000
4FFF
4K MEMORY
#4
4000
3FFF
4K MEMORY
#3
3000
2FFF
4K MEMORY
#2
2000
1FFF
4K MEMORY
#1
1000
0FFF
4K MEMORY
#0
0000

All addresses are in hexadecimal

SwTPC 6800 Memory Map

Figure 1

Parts List MP-B Mother Board

Resistors

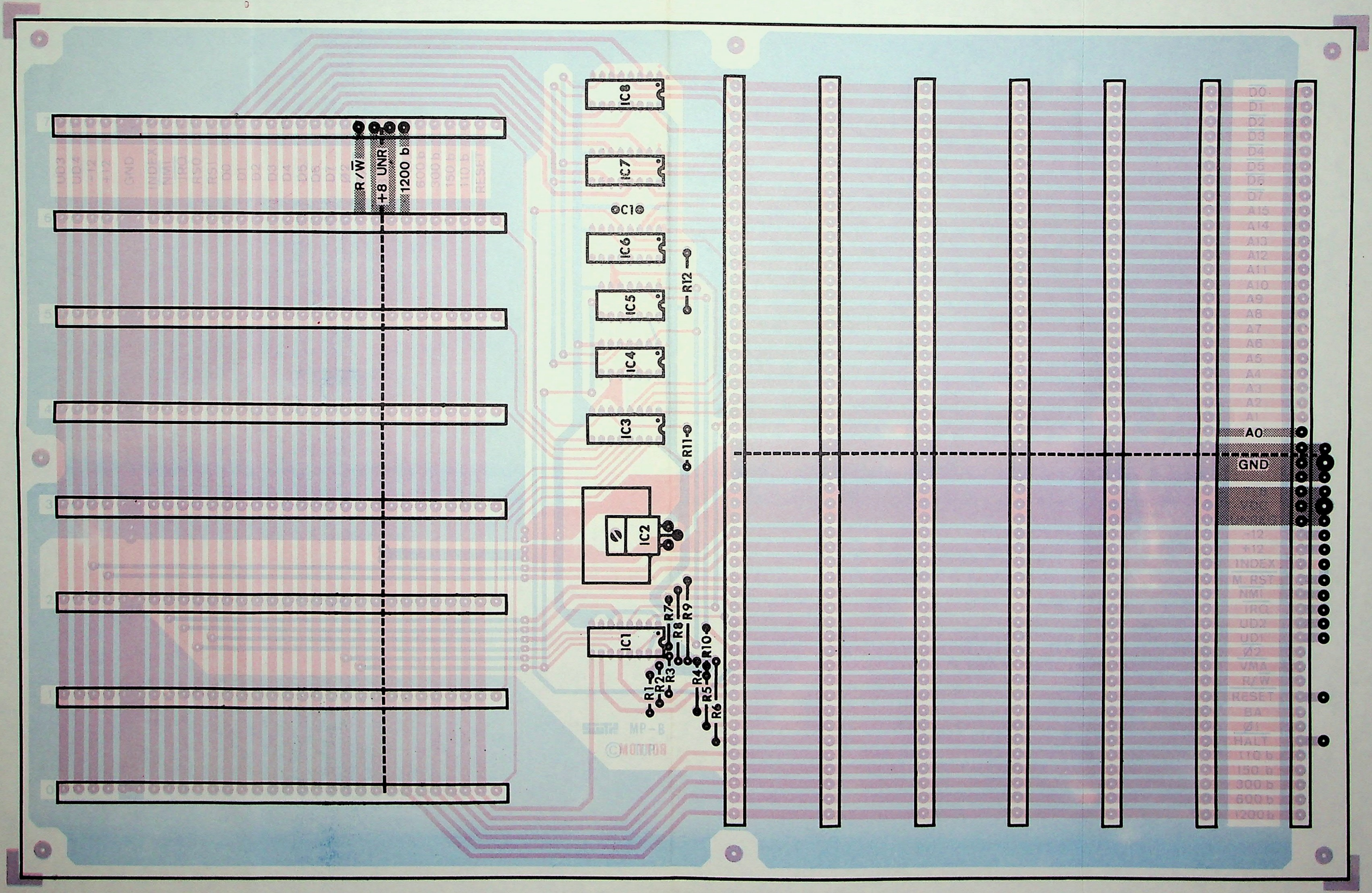
R1 - R6, R10	470 ohm 1/4 watt resistor
R7, R8	6.8K ohm 1/4 watt resistor
R9, R11, R12	1K ohm 1/4 watt resistor

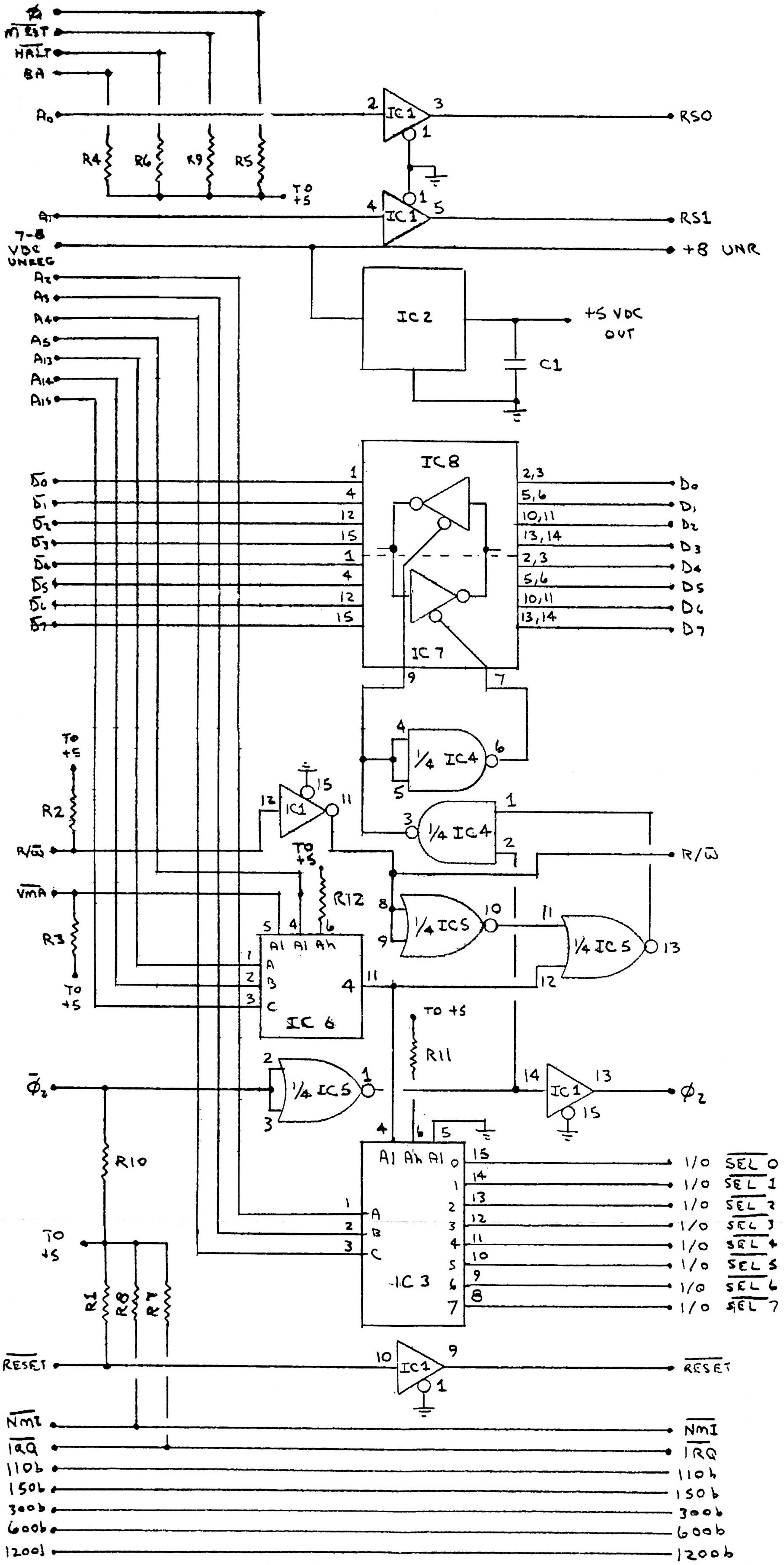
Capacitors

C1	0.1 mfd disc capacitor

Integrated Circuits

IC-1	DM8097/74367/74LS367
IC-2	7805 +5 VDC Voltage Regulator
IC-3, IC-6	74S138 1 of 8 decoder
IC-4	7400 Quad NAND Gate
IC-5	7402 Quad NOR Gate
IC-7, IC-8	DM8835/DS8835

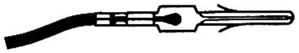

R/W
+8 UNR
1200 b
IC8
IC7
C1
IC6
R12
IC5
IC4
IC3
R11
IC2
IC1
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
MP-B
D0
D1
D2
D3
D4
D5
D6
D7
A15
A14
A13
A12
A11
A10
A9
A8
A7
A6
A5
A4
A3
A2
A1
A0
GND
-12
+12
INDEX
M RST
NMI
IRQ
UD2
UD1
Ø2
VMA
R/W
RESET
BA
Ø1
HALT
110 b
150 b
300 b
600 b
1200 b


Ø2
M RST
HALT
BA
A0
R4
R6
R9
R5
TO +5
IC1
RS0
A1
RS1
7-8 VDC UNREG
+8 UNR
A2
A3
A4
A5
A13
A14
A15
IC2
+5 VDC OUT
C1
D0
D1
D2
D3
D4
D5
D6
D7
IC8
IC7
D0
D1
D2
D3
D4
D5
D6
D7
1/4 IC4
R/W
R2
TO +5
VMA
R3
R12
IC6
1/4 IC5
R11
Ø2
R10
IC3
I/O SEL 0
I/O SEL 1
I/O SEL 2
I/O SEL 3
I/O SEL 4
I/O SEL 5
I/O SEL 6
I/O SEL 7
R1
R8
R7
RESET
NMI
IRQ
110b
150b
300b
600b
1200b

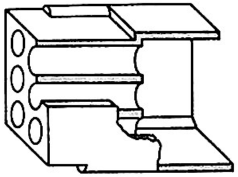
Schematic - MP-B Mother Board

Connector Reference Sheet

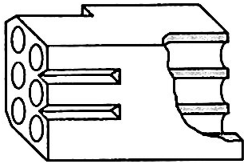
In order to avoid confusion in distinguishing between the various connectors supplied with our many kits, we are including this connector reference sheet with the kit instruction set. We have had a great many customers interchange the male and female connector shells when assembling their kits so we have clearly illustrated each connector along with its proper name and gender on this reference sheet. All are shown actual size.



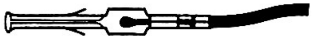
Male Pin



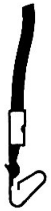
Molex Female Shell Connector



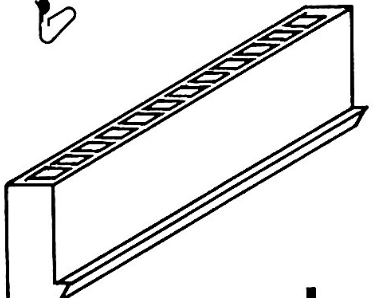
Molex Male Shell Connector



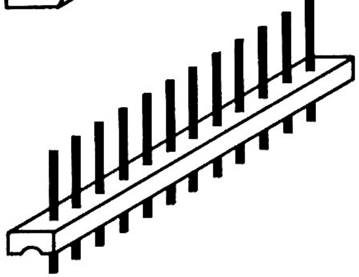
Female Pin



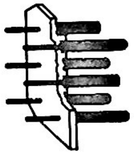
Pin for Harness Connector



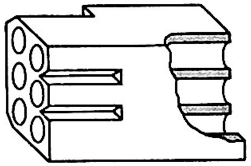
Harness Connector



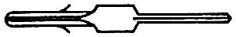
Straight Pin Edge Connector



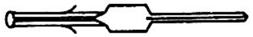
Molex Wafercon®



Molex Male Shell Connector

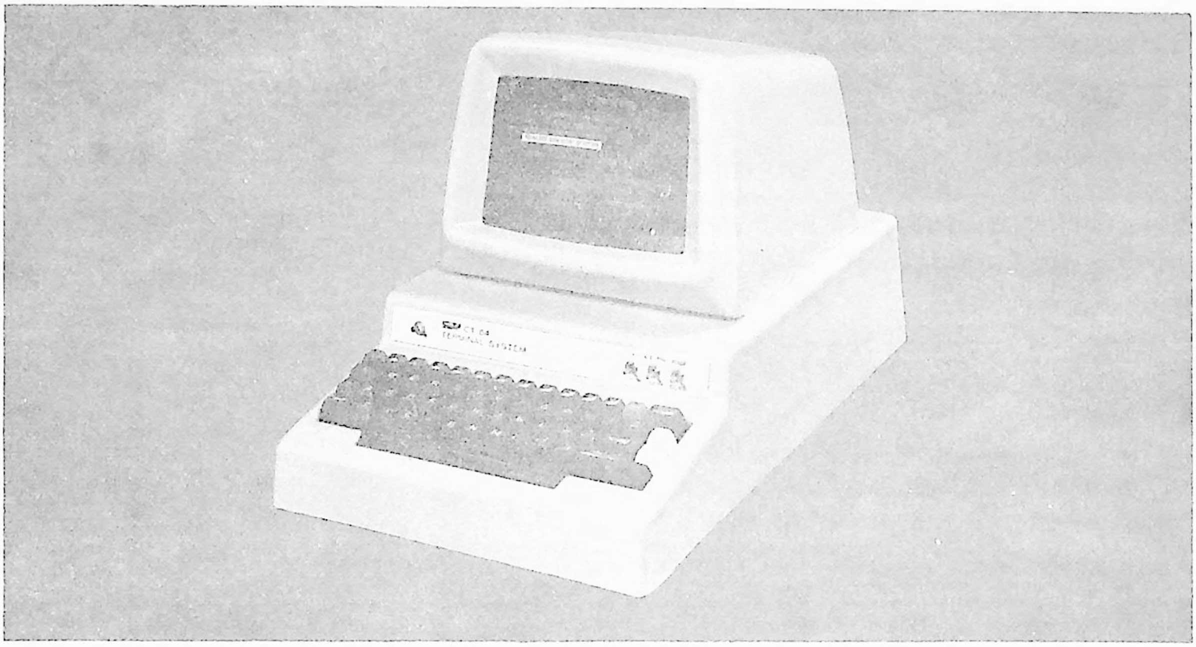


Male Solder Tail Pin
PC Type



Female Solder Tail Pin
PC Type

CT-64 TERMINAL SYSTEM



- 64 OR 32 CHARACTERS PER LINE
- UPPER AND lower case LETTERS
- FULL 8 BIT MEMORY
- 128 CHARACTER ASCII SET
- 110/220 Volt 50-60 Hz POWER SUPPLY
- SCROLLING OR PAGE MODE OPERATION
- CONTROL CHARACTER DECODING–32 COMBINATION
- PRINTS CONTROL CHARACTERS
- USABLE WITH ANY 8 BIT ASCII COMPUTER
- REVERSED BACKGROUND – HIGHLIGHTING

COMPLETE WITH – Chassis and cover, cursor control, 110-1200 Baud serial interface and keyboard. Optional monitor show in photo available.

Now you can buy it. The terminal that has all the features that people have been asking us to include. The CT-64 has all the functions that you could want in a terminal and they may be operated by either switches, or through a software program.

All cursor movements, home-up and erase, erase to end of line, erase to end of frame, read on, read off, cursor on, cursor off, screen reversal, scroll, no scroll, solid cursor, blinking cursor, page selection and a beeper to warn you of end of page; all are provided for your use in the CT-64.

You may also switch from upper case only teletype style operation to upper-lower case typewriter style operation. You can reverse the field on individual words to highlight them, or you can reverse the whole screen.

CT-64 is complete with keyboard, power supply serial interface and case. A matching 9 inch monitor with coordinated covers is also available to make a complete system.

CT-64 Terminal Kit	$325.00
MM-1 Monitor (assembled)	$175.00

SWTPc

219 W. Rhapsody

San Antonio, Texas 78216

You are right, it's just what I have been asking for.

☐ Enclose is $325.00 for the CT-64

☐ Send the MM-1 monitor too. ☐ Send Data

☐ or BAC ____________ #____________

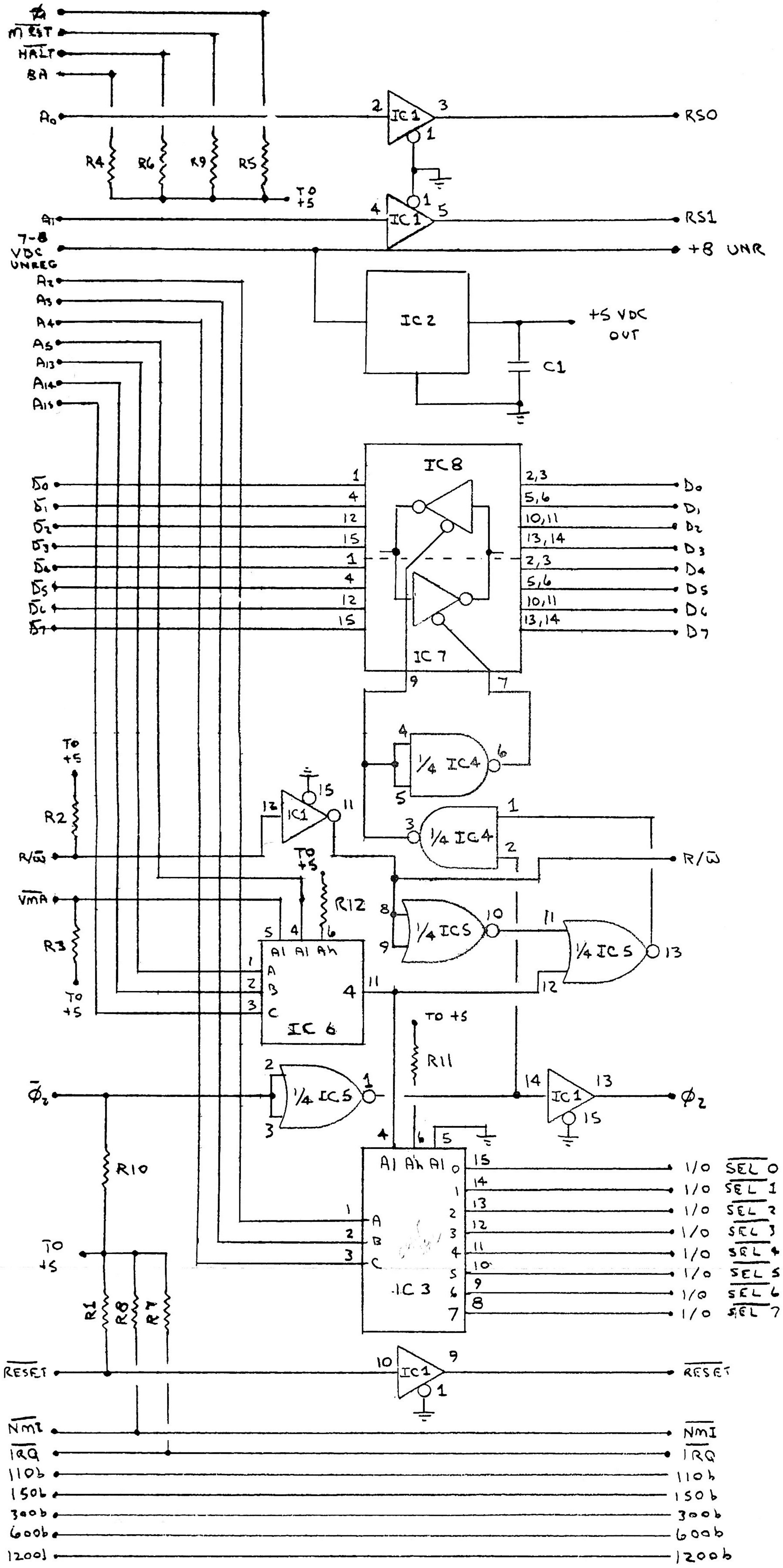
☐ or MC____________ Ex Date____________

____
NAME

____
ADDRESS

____
CITY STATE ZIP

Southwest Technical Products Corp.
219 W. Rhapsody, San Antonio, Texas 78216


Ø1
M RST
HALT
BA
A0
R4
R6
R9
R5
TO +5
IC1
RS0
RS1
A1
7-8 VDC UNREG
+8 UNR
A2
A3
A4
A5
A13
A14
A15
IC2
+5 VDC OUT
C1
IC8
IC7
D0
D1
D2
D3
D4
D5
D6
D7
1/4 IC4
R2
R/W
VMA
R3
R12
1/4 IC5
IC6
A B C
R11
Ø2
R10
IC3
I/O SEL 0
I/O SEL 1
I/O SEL 2
I/O SEL 3
I/O SEL 4
I/O SEL 5
I/O SEL 6
I/O SEL 7
R1
R8
R7
RESET
NMI
IRQ
110b
150b
300b
600b
1200b

Schematic - MP-B Mother Board

Assembly Instructions MP-C Serial, Control Interface

Introduction

The MP-C Control Interface is a 5 1/4" x 3 1/2" double sided, plated thru hole board which is meant to interface a serial terminal to the Computer System for both system control and when selected, user program input/output. It may be jumper configured to operate serially at either 110 baud (10 characters/second) or 300 baud (30 characters/second) with an upper case ASCII terminal RS-232C or 20 Ma TTY compatable. Baudot coded TTY's are not compatable with this interface, they must be ASCII coded. Our CT-1024 terminal system kit, however, is compatable. All terminal input/output data is made thru a ten pin connector installed along the top edge of the board. Power for the board is supplied by a +5V voltage regulator and has a current consumption of approximately 0.2A.

When the SWTPC 6800 Computer System is being assembled, work on only one board at a time. Each of the system's boards and their associated parts must not be intermixed to avoid confussion during assembly. The MOS integrated circuits supplied with this kit are susceptible to static electricity damage and for this reason have been packed with their leads impressed onto a special conductive foam or possibly wrapped in a conductive foil. In either case, do not remove the protective material until specifically told to do so later in the instructions.

PC Board Assembly

NOTE: Since all of the holes on the PC board have been plated thru, it is only necessary to solder the components from the bottom side of the board. The plating provides the electrical connection from the "BOTTOM" to the "TOP" foil of each hole. Unless otherwise noted it is important that none of the connections be soldered until all of the components of each group have been installed on the board. This makes it much easier to interchange components if a mistake is made during assembly. Be sure to use a low wattage iron (not a gun) with a small tip. Do not use acid core solder or any type of paste flux. We will not guarantee or repair any kit on which either product has been used. Use only the solder supplied with the kit or a 60/40 alloy resin core equivalent. Remember all of the connections are soldered on the bottom side of the board only. The plated-thru holes provide the electrical connection to the top foil.

(✓) Before installing any parts on the circuit board, check both sides of the board over carefully for incomplete etching and foil "bridges" or "breaks". It is unlikely that you will find any but should there be on especially on the "TOP" side of the board it will be very hard to locate and correct after all of the components have been installed on the board.

(✓) Attach all of the resistors to the board. As with all other components unless noted, use the parts list and component layout drawing to locate each part and install from the "TOP" side of the board bending the leads along the "BOTTOM" side of the board and trimming so that 1/16" to 1/8" of wire remains. Solder.

(✓) Install all of the capacitors on the board. Solder.

( ) Install the transistors and diodes on the board. The diodes must be turned so the banded end corresponds with that shown on the component layout drawing, and the transistors must be turned to match the outlines on the component layout drawing as well. Sandwich the nylon spacer between the body of transistor Q2 and the circuit board. Solder.

(✓) Starting from one end of the circuit board install each of the three, 10 pin Molex female edge connectors along the lower edge of the board. These connectors must be inserted from the "TOP" side of the board and must be pressed down firmly against the board. Make sure the body of the connector seats firmly against the circuit board and that each pin extends completely into the holes on the circuit board. Not being careful here will cause the board to either wobble and/or be crooked when plugged onto the mother board. It is suggested that you solder only the two end pins of each of the three connectors until all have been installed at which time if everything looks straight and rigid you should solder the as yet unsoldered pins.

(✓) Following the procedure outlined above, attach the remaining 10 pin Molex female edge connector along the upper edge of the board.

(✓) Insert the small nylon indexing plugs into both the upper and lower edge connector pins indicated by the small triangular arrow on the "BOTTOM" side of the circuit board. This prevents the board and I/O connector from being accidently plugged on incorrectly.

(✓) Install integrated circuits IC5 thru IC9. As each one is installed make sure it is down firmly against the board and solder only two of the leads to hold the pack in place while the other IC's are being inserted. Be very careful to install each in its correct position. Do not bend the leads on the back side of the board. Doing so makes it very difficult to remove the integrated circuits should replacement ever be necessary. The semicircle notch, dot or bar on the end of the package is used for orientation purposes and must match with the outlines shown on the component layout drawing for each of the IC's. After inserting all of the integrated circuits go back and solder each of the as yet unsoldered pins.

(✓) Install integrated circuit IC2 on the circuit board. This component must be oriented so its metal face is facing the circuit board as is secured to the circuit board with a #4 -40 x 1/4" screw, lockwasher and nut. A heatsink is not used. The three leads of the integrated circuit must be bent down into each of their respective holes. Solder.

NOTE: MOS integrated circuits are susceptable to damage by static electricity. Although some degree of protection is provided internally within the integrated circuits, their cost demands the utmost in care. Before opening and/or installing any MOS integrated circuits you should ground your body and all metallic tools coming into contact with the leads, thru a 1 M ohm 1/4 watt resistor (supplied with the kit). The ground must be an "earth" ground such as a water pipe, and not the circuit board ground. As for the connection to your body, attach a clip lead to your watch or metal ID bracelet. Make absolutely sure you have the 1 Meg ohm resistor connected between you and the "earth" ground, otherwise you will be creating a dangerous shock hazard. Avoid touching the leads of the integrated circuits any more than necessary when installing them, even if you are grounded. On those MOS IC's being soldered in place, the tip of the soldering iron should be grounded as well (separately from your body ground) either with or without a 1 Meg ohm resistor. Most soldering irons having a three prong line cord plug already have a grounded tip. Static electricity should be an important consideration in cold, dry environments. It is less of a problem when it is warm and humid.

(✓) Install MOS integrated circuits IC1, IC3 and IC4 following the precautions given in the preceding section. As each is installed, make sure it is down firmly against the board before soldering all of its leads. Be very careful to install each in it's correct position. Do not bend the leads on the back side of the board. Doing so makes it very difficult to remove the integrated circuits should replacement ever be necessary. The "dot" or "notch" on the end of the package is used for orientation purposes and must match with that shown on the component layout drawing for each of the IC's.

(✓) The board should now be jumper programmed for either 110 baud (10 characters per second) or 300 baud (30 characters per second) operation. It is desirable to program the board for 300 baud operation if possible (RS-232 only). For 110 baud operation jumper point "C" on the board to the "110" point just to the left of point "C". Also jumper point "D" on the board to the "110" point just to the left of point "D". For 300 baud operation jumper point "C" on the board to the "300" point just to the left of point "C". Also jumper point "D" on the board to the "300" point just to the left of point "D". Make these connections using two 1" pieces of light gauge insulated wire and attach them so they may easily be removed should you wish to reconfigure the board at a later time. No connections should be made to the "A", "B", "NMI" and "IRQ" points.

( ) Working from the "TOP" side of the circuit board, fill in all of the feed-thru's with molten solder. The feed-thru's are those unused holes on the board whose internal plating connects the "TOP" and "BOTTOM" circuit connections. Filling these feed-thru's with molten solder guarantees the integrity of the connections and increases the current handling capability. Be sure not to fill in the holes marked "110", "300", "NMI", "A", "B" and "IRQ".

(✓) Now that all of the components have been installed on the board, double check to make sure all have been installed correctly in their proper location.

( ) Check very carefully to make sure that all connections have been soldered. It is very easy to miss some connections when soldering which can really cause some hard to find problems later during checkout. Also look for solder "bridges" and "cold" solder joints which are another common problem.

Since the MP-C circuit board now contains MOS devices it is susceptable to damage from severe static electrical sources. One should avoid handling the board any more than necessary and when you must, avoid touching or allowing anything to come into contact with any of the conductors on the board.

Input/Output (I/O) Connector Wiring

Actual I/O connections are made thru the 10 pin connector along the top edge of the board. The 10 pin male connector should be attached to the control terminal's cable as outlined in the instructions below and my be jumper configured for either RS-232 (TV typewriter format) or 20 Ma TTY (ASR-33 TTY format) operation. There are nine connection points on the I/O connector with the tenth used for indexing which prevents the male connector from being plugged on incorrectly. The function of each of the nine is abreviated on the "BOTTOM" side of the board beneath the connector with a detailed description of each as follows:

	This is the system's ground point and is the "common" return line for the RS-232 input (RI) and output (RO)
CO	The Clock Output (CO) line is used for self clocking cassette tape interface systems. If you do not have a self clocking cassette tape system connected to this interface, this point must be jumpered to the Clock Input (CI) point on the male connector for the system to work. The actual output of this line is a CMOS compatable (not TTL) square wave whose frequency is 1758.8 Hz when the board is programmed for 110 baud operation and 4800.0 Hz when the board is programmed for 300 baud operation.
CI	The Clock Input (CI) is also used for self clocking cassette tape interface systems. If you do not have a self clocking cassette tape system connected to this interface, this point must be jumpered to the Clock Output (CO) point on the male connector for the system to work.
RI	The RS-232 Input (RI) is the interface's voltage activated input which conforms to RS-232 specifications. It is the input to use when tying the computer system to the SWTPC CT-1024 Terminal System via its CT-S serial interface option. If you are not using the RS-232 Input (RI), it must be jumpered to the ground pin of the male connector.
RO	The RS-232 Output (RO) is the interface's voltage activated output which conforms to RS-232 sepcifications. It is the output to use when tying the computer system to the SWTPC CT-1024 Terminal System via it's CT-S serial interface option. When not in use leave open; do not jumper to ground.
TC	The TTY Common (TC) line is the "common" return line for the 20 Ma TTY compatable input and output and the Reader Control (RC) output. Electrically it is the same as the -12 VDC power supply buss.
TO	The 20 Ma TTY Output (TO) is the interface's current activated output. It is the output to use when tying the Computer System to an ASR-33 or similar TTY configured for 20 Ma full duplex operation.
RC	The Reader Control output (RO) is a line which may be used to implement automatic reader/punch operation on a TTY not having the "automatic" function already built in. It does so by activating a reed relay incorporated into the TTY system. Complete details are given later in the instructions.

TI The TTY Input (TI) is the interface's current activated input. It is the input to use when connecting the Computer System to an ASR-33 or similar teletype configured for 20 Ma full duplex operation. If you are not using the TTY Input (TI), it must be jumpered to the TTY Common (TC) pin on the male connector.

Attaching the I/O Connector to the Interface

The male I/O connector which is attached to the interface is simply a row of ten pins supported by a nylon base. The longer side of the male connector plugs onto the interface board edge connector while the cable wires going to the control terminal are soldered onto the shorter side of the connector. The cable which goes back to the interface should, if at all possible, be a multi-conductor cable (not supplied with the kit) with a minimum of five separate conductors.

When preparing to attach the cable to the connector, first strip back 2" of the cable's outer insulation. While positioning the cable in line with the male connector's nylon support strip allowing the wires to extend just beyond the last pin on the strip, attach and solder each of the appropiate wires following the wiring diagram (given later in the instructions) oriented so the ground pin (⏚) is connected to the shortest wire. It is very easy to melt the body of the nylon connector which will loosen the pins, so be very careful and use a heatsink on each pin between the solder point and connector body where possible. After attaching all of the cable wires bend the connector around the cable a full 180 degrees and secure with two wire ties (supplied with the kit). Now cut off the indexing pin on the male connector.

Configuring the Interface(s)

When operating the interface in the TTY mode you must have the serial control interface (MP-C) configured for 110 baud operation as was detailed earlier in the instructions. In this mode the interface operates at 110 baud with one start bit, 8 data bits (no parity) and two stop bits. TTY's operate with this same fixed data format.

When operating the interface in the RS-232 mode you may operate it at either 110 or 300 baud (jumper programmable as detailed earlier in the instructions). You must of course have the terminal's interface (CT-S board on the CT-1024 configured for the same baud rate. The 300 baud rate is preferable if your terminal will handle it. This will make future cassette tape stored data transfer three times faster than it would be at 110 baud operation. No matter which baud rate you select, the terminal must be configured for handling 8 data bits, with bit 8 either a zero or one but preferably a 0, with no parity selection. There should be two stop bits for 110 baud operation and one stop bit for 300 baud operation. Details for configuring the parity and bit arrangements of the CT-S interface on the CT-1024 terminal system are in the CT-S instruction set. The CT-S interface automatically selects two stop bits for 110 baud operation and one stop bit for 300 baud operation.

This completes the assembly phase for the MP-C board. Actual checkout procedures are given in the System Checkout Instructions provided with the MP-B Mother Board, however the System Assembly Instructions are used only after having assembled the MP-A Microprocessor/System Board, MP-B mother board, MP-C serial control interface and the MP-P power supply.

RS-232 Operation (CT-1024 Users)

If you will be operating the interface with an ASCII coded, RS-232 terminal such as the CT-1024 terminal system with the CT-S serial interface, you will have to configure both the terminal and computer interfaces for compatable operation.

To interconnect the two, make the connections illustrated in Figure 1.

( ) Run a jumper between the TI and TC pins on the interface connector plug.

( ) On the terminal end of the I/O cable solder two of the wires in the cable together. On the computer's interface connector plug end attach one of these wires to the CI pin and the other to the CO pin.

( ) Attach another of the terminal I/O cable wires from the RS-232 output of the terminal's serial interface (CT-S jack JS-1 pin 6) to the RI pin on the computer's interface connector plug.

( ) Attach another of the terminal I/O cable wires from the RS-232 input of the terminal's serial interface (CT-S jack JS-1 pin 7) to the RO pin on the computer's interface connector plug.

( ) Attach another of the terminal I/O cable wires from the ground of the terminal's serial interface (CT-S JS-1 pin 1) to the ⏚ pin on the computer's interface connector plug.

( ) Be sure you have configured the baud rate and parity of both the computer and terminal interfaces as called for earlier in the instructions.

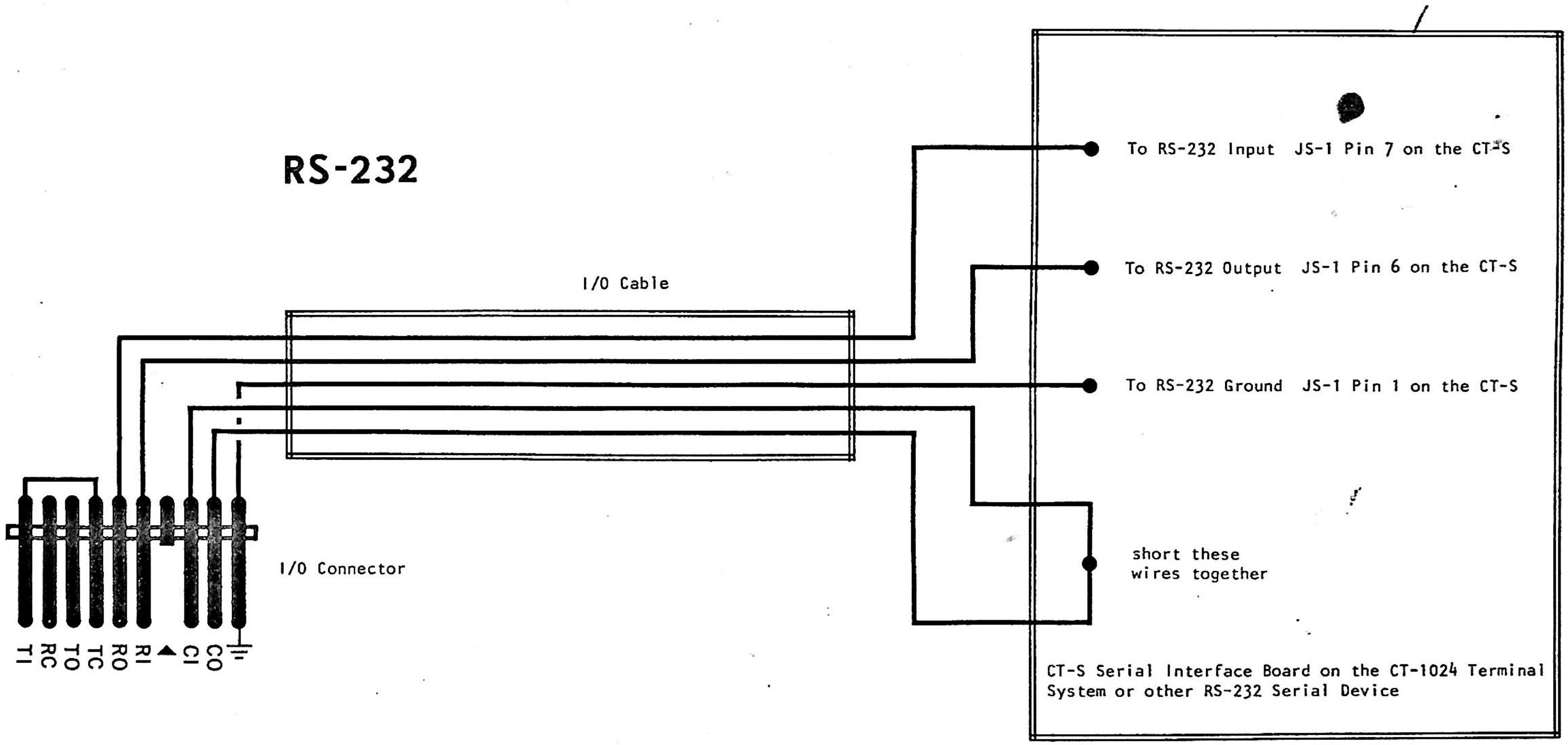

RS-232
I/O Cable
I/O Connector
TI
RC
TO
TC
RO
RI
CI
CO
To RS-232 Input JS-1 Pin 7 on the CT-S
To RS-232 Output JS-1 Pin 6 on the CT-S
To RS-232 Ground JS-1 Pin 1 on the CT-S
short these wires together
CT-S Serial Interface Board on the CT-1024 Terminal System or other RS-232 Serial Device

Figure 1 Wiring Diagram - Attaching a Serial RS-232 Device to the MP-C or MP-S Interfaces

Teletype® Operation (TTY)

If you will be operating the interface with an ASCII coded Teletype® (TTY), you will have to configure TTY for full duplex, 20 Ma current loop operation and the interface for 110 baud, TTY operation. The interface will work with ASCII coded terminals only. It will not work with the older 5-level baudot coded terminals.

Although you should refer to the TTY manufacturer's documentation for specific details you can generally configure the TTY for full duplex, 20 Ma operation as follows:

(In reference to the I/O terminal strip inside the TTY-see figure 2)

( ) Connect the white/blue wire to terminal 5.

( ) Connect the brown/yellow wire to terminal 5.

( ) Connect the violet wire to terminal 9.

(In reference to the power resistor behind the power supply inside the TTY)

( ) Move the blue wire from the 750 ohm tap to the 1450 ohm tap.

To configure the interface for 110 baud, TTY operation and for attachment to the TTY, make the connections illustrated in figure 2.

( ) Run a jumper between the CI and the CO pins on the interface connector plug.

( ) Run a jumper between the ⏚ and the RI pins on the interface connector plug.

( ) Attach one of the TTY I/O cable wires from terminal 7 of the TTY's terminal strip to the TO pin on the interface connector plug.

( ) Run a jumper between terminals 4 and 6 on the TTY's terminal strip.

( ) Attach another of the TTY I/O cable wires from terminal 6 of the TTY's terminal strip to the TC pin on the interface connector plug.

( ) Attach another of the TTY I/O cable wires from terminal 3 of the TTY's terminal strip to the TI pin on the interface connector plug.

( ) Configure the MP-C serial control interface for 110 baud operation if you have not already done so by jumpering point "C" on the board to the "110" pad to its immediate left and jumper point "D" on the board to the separate "110" pad to its immediate left. There should be no connections to either of the "300" pads on the board.

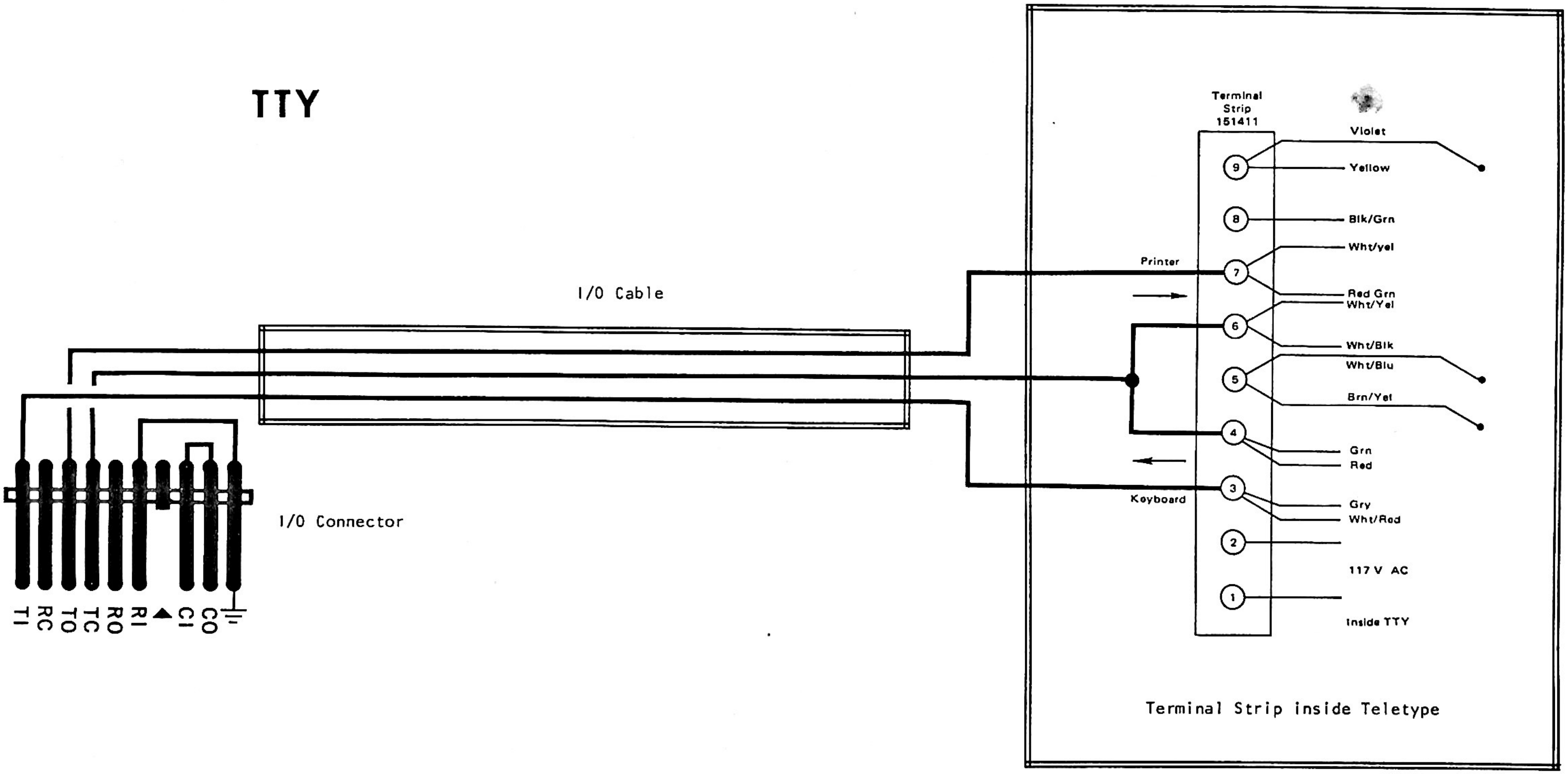

TTY
I/O Cable
I/O Connector
TI
RC
TO
TC
RO
RI
▲
CI
CO
Terminal
Strip
151411
Violet
Yellow
Blk/Grn
Wht/yel
Printer
Red Grn
Wht/Yel
Wht/Blk
Wht/Blu
Brn/Yel
Grn
Red
Keyboard
Gry
Wht/Red
117 V AC
Inside TTY
9
8
7
6
5
4
3
2
1
Terminal Strip inside Teletype

Figure 2 Wiring Diagram - Teletype Configuring and Connections to the MP-C or MP-S Interfaces

The board is now configured for full duplex, 20 Ma TTY operation.

The SWTPC 6800 Computer System is designed to work with a TTY having an automatic reader/punch feature (under software control). If your teletype does not have this feature, you can add it by incorporating the following modifications:

( ) Using the parts list below, the parts layout in figure 3 and the schematic shown in figure 5, construct the circuit on a piece of vector board. Note: We do not supply these parts.

PARTS LIST:

1 EA.	Reed Relay	12V, 600 ohm coil Potter Brumfield # JR-1005 or equiv.
1 EA.	Resistor	470 ohm 1/2 watt
1 EA.	Capacitor	0.1 mfd @600 VDC
1 EA.	Diode	1N5060 or equiv.
1 EA.	Board	Vector Board (2.5" x 3.8")

( ) Mount the component board on the teletype using the holes in the terminal's mounting plate as shown in figure 4.

( ) Refering to the schematic in figure 5, connect the relay, capacitor and resistor into the TTY's circuitry. The LINE and LOCAL lines must be connected to the line/off/local switch as shown in figure 5. Make sure no voltages from the TTY are accidentally connected to the relay's primary windings. Such a voltage can damage the SWTPC 6800 Computer System.

( ) The relay coil is controlled by the reader control line (RC) with respect to the TC line on the interface board, so be sure to connect the relay's coil windings back to the RC and TC points on the interface connector plug thru the I/O cable.

Teletype® is a registered trademark of the Teletype Corporation.

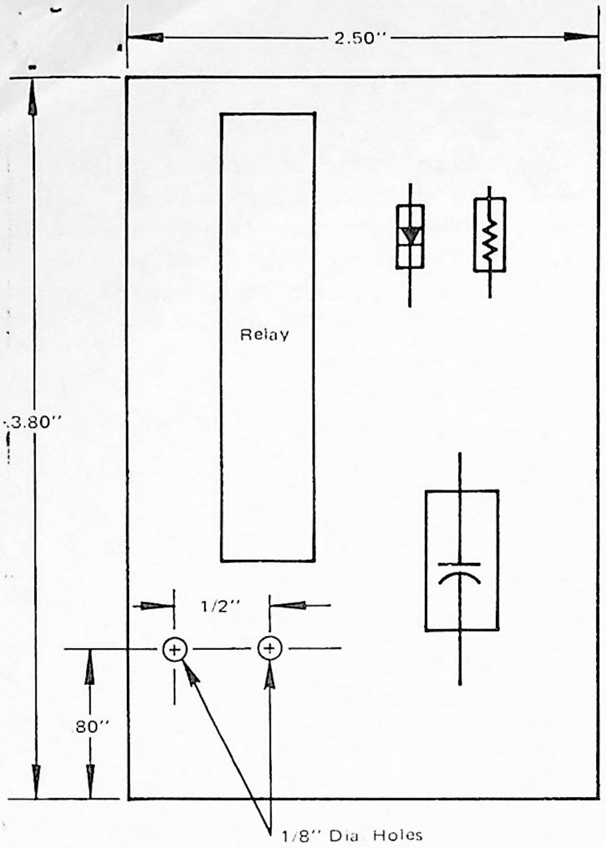

2.50"
3.80"
Relay
1/2"
80"
1/8" Dia Holes

Figure 3

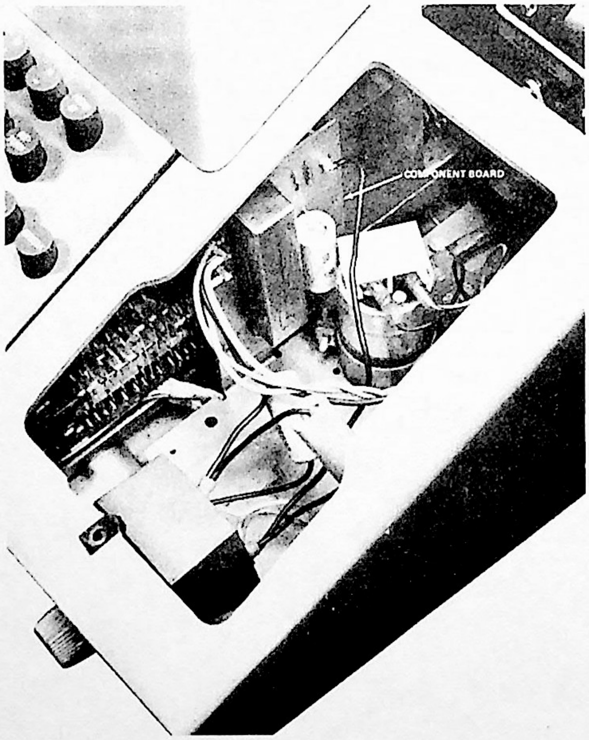
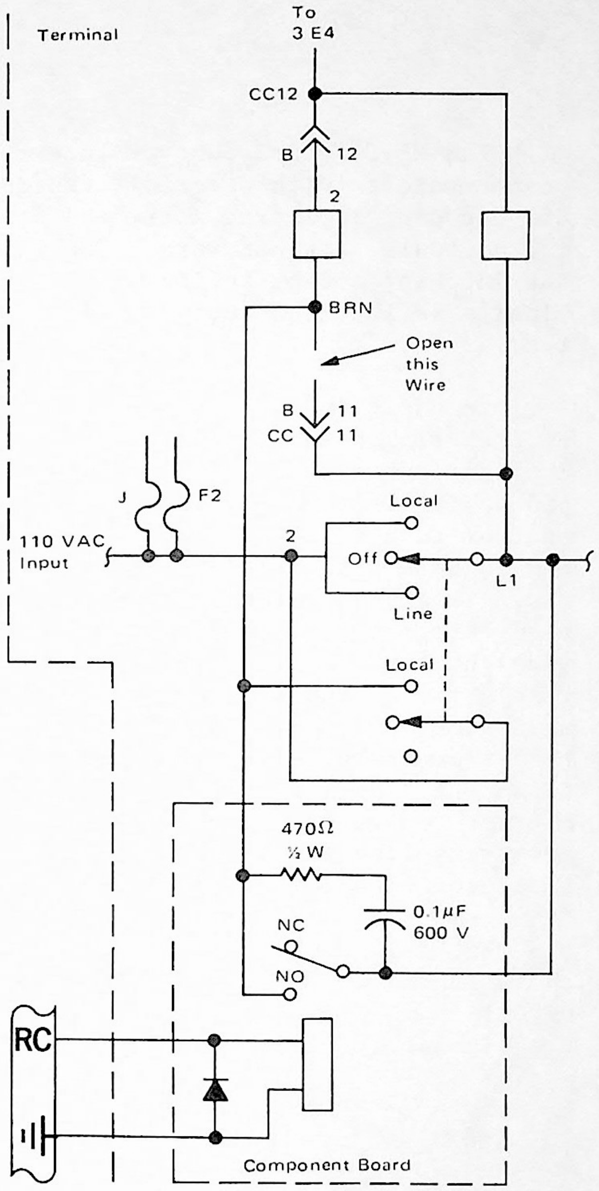

COMPONENT BOARD

Figure 4


Terminal
To
3 E4
CC12
B
12
2
BRN
Open
this
Wire
B
11
CC
11
J
F2
Local
110 VAC
Input
2
Off
L1
Line
Local
470Ω
½ W
0.1μF
600 V
NC
NO
RC
Component Board

TTY Terminal Schematic Incorporating
Automatic Reader Control

Figure 5

Upgrading a Teletype for
Automatic Reader/Punch Operation

How It Works

The MP-C Serial Control Interface uses IC1 a parallel type interface chip to communicate with a serial, control terminal. The actual serial encoding and decoding including start and stop bits is done by the computer itself using software, not hardware. The parallel interface chip is used to provide the latching and buffering necessary to interface to the computer to the terminal's serial input/output lines. (CT-S board on the CT-1024 Terminal System).

In addition, two control inputs and three control outputs are provided. By jumpering point "C" on the board to the "110" pad to its left the board is configured for 2 stop bits. By jumpering point "C" on the board to the "300" pad to its left, the board is configured for one stop bit. This is one of the control inputs. The other control input is derived indirectly from the input fed to baud rate selection pad, point "D". It is used for generating the timing signals to correctly encode and decode serial data at the selected baud rate. The PB0 and PB2 outputs of IC1 are also indirectly used to provide the timing signals for 5 stage divider, IC3 and NAND gate IC4, to correctly encode and decode the serial data. The CB2 output is used to generate a "Reader Control" output which may be used for TTY's not have inte automatic reader/punch function. It is also used to give program control over the input to output "echo" function of the interface. NAND gate IC5 provides the OR ing of computer generated data or input "echoed" data (when enabled) so that both are transmited to the terminal. Optional Couplers IC7 thru IC9 are used for isolation on the various interface inputs/outputs.

Both -12 and +12 voltages are required by the interface for RS-232/TTY communication. These lines are not regulated and are derived from the computer's power supply board. +5 VDC power for the board is supplied by voltage regulator IC2.

Parts List MP-C Serial Control Interface

Resistors

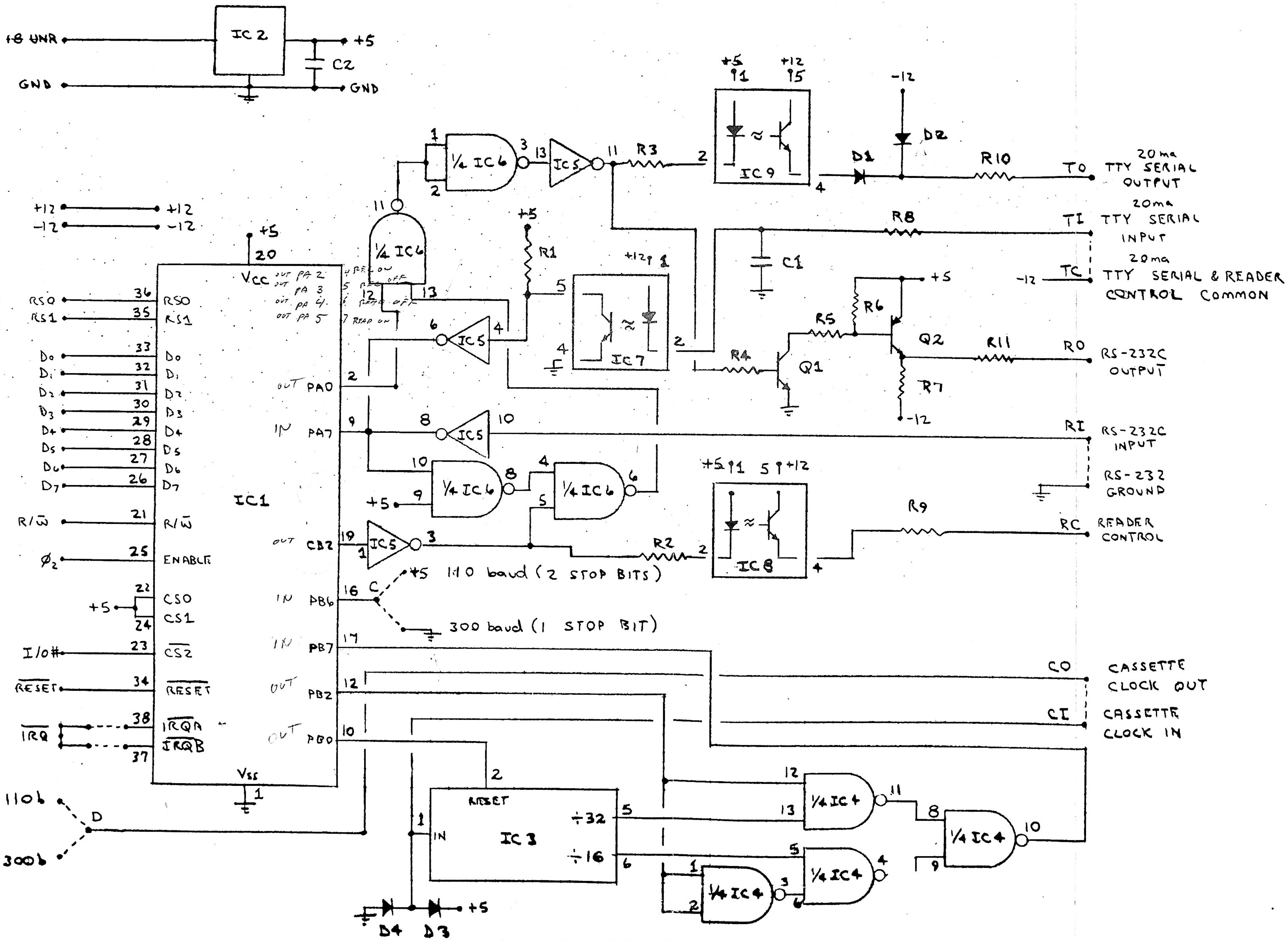
R1, R2, R3	680 ohm 1/4 watt resistor
R4, R5	10K " " " "
R6	47K " " " "
R7	2.7K " " " "
R8	1.1K ohm 1 watt resistor
R9	330 ohm 1/2 watt resistor
R10	820 ohm 1 watt resistor
R11	100 ohm 1/4 watt resistor

Capacitors

C1	0.1 mfd mylar capacitor
C2	0.1 mfd disc capacitor

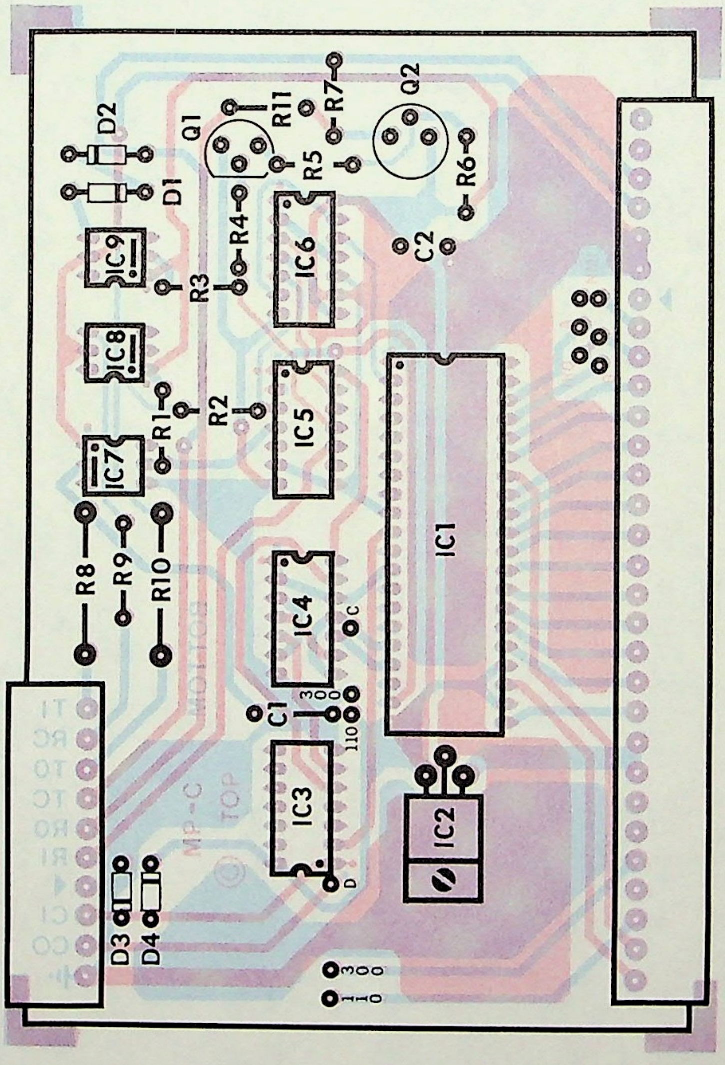
Semiconductors

D1, D2	1N4003 silicon diode
D3, D4	1N914/1N4148 silicon diode (sm.glass case)
Q1	2N5210 silicon transistor
Q2	SS1122 silicon transistor
IC1	MC6820 peripheral interface adaptor (MOS)
IC2	7805 5 VDC voltage regulator
IC3	CD4024AE CMOS binary counter (MOS)
IC4	CD4011A CMOS quad NAND gate (MOS)
IC5	1489AJ quad RS-232 receiver
IC6	7400 quad NAND gate
IC7 - IC9	4N33 optical coupled isolator



+8 UNR
GND
IC 2
C2
+5
GND
+12
-12
+5
20
Vcc
IC1
RS0
RS1
36
35
D0
D1
D2
D3
D4
D5
D6
D7
33
32
31
30
29
28
27
26
R/W̄
21
φ2
25
ENABLE
+5
22
24
CS0
CS1
I/O#
23
CS2
RESET
34
IRQ
38
37
IRQA
IRQB
Vss
1
OUT PA2
OUT PA3
OUT PA4
OUT PA5
4 REC ON
5 REC OFF
6 READ OFF
7 READ ON
OUT PA0
IN PA7
OUT CB2
IN PB6
IN PB7
OUT PB2
OUT PB0
1/4 IC6
IC5
IC9
IC7
IC8
IC3
1/4 IC4
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
C1
D1
D2
D3
D4
Q1
Q2
+5 1
+12 5
+12 1
+5 1
5 +12
-12
TO
20ma TTY SERIAL OUTPUT
TI
20ma TTY SERIAL INPUT
TC
20ma TTY SERIAL & READER CONTROL COMMON
RO
RS-232C OUTPUT
RI
RS-232C INPUT
RS-232 GROUND
RC
READER CONTROL
C
+5 110 baud (2 STOP BITS)
300 baud (1 STOP BIT)
CO
CASSETTE CLOCK OUT
CI
CASSETTE CLOCK IN
RESET
IN
÷32
÷16
110b
300b
D

Schematic - MP-C Serial Control Interface


D2
D1
Q1
R11
R7
Q2
R5
R6
IC9
IC8
IC7
R4
R3
R2
R1
C2
IC6
IC5
IC4
IC3
IC2
IC1
R8
R9
R10
C1
C
D
MP-C
TOP
TI
RC
TO
TC
RO
RI
CI
CO
D3
D4
300
110

SERIAL